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SELECTED WATER RESOURCES ABSTRACTS

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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 12, NUMBER 10
MAY 15, 1979

W79-04501—W79-05000

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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03 WATER SUPPLY AUGMENTATION AND CONSERVATION
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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

PUBLIC GROUNDWATER SUPPLIES IN WARREN COUNTY,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 7C.
W79-04720

OPTICS OF TURBID ESTUARINE WATERS: APPROXIMATIONS AND APPLICATIONS,
Hydroscience, Inc., Westwood, NJ.
D. M. Di Toro.
Water Research, Vol. 12, No. 12, p 1059-1068. 8 fig, 2 tab, 22 ref.

Descriptors: *Water properties, *Estuaries, *Turbidity, *Optical properties, *California, Estuarine environment, Reflectance, Suspended solids, Analytical techniques, Analysis, On-site data collections, Equations, Opacity, Chlorophyll, Measurement, Mathematical models, *San Francisco Bay Estuary.

An analysis of the radiative transfer equation was presented which is applicable for the case of angle-independent, exponentially decreasing irradiance. The results indicated that for reflectance ratios less than 10%, the extinction coefficient of downwelling irradiance is due to particle absorption and the fraction of particle scattering that is not directly forward scattered. The equations for extinction coefficient and reflectance ratio were compared to numerical solutions and other approximations. Solar angle dependence was derived from the quasi-single scattering approximation. Application of these equations to a large data set from the San Francisco Bay Estuary yielded estimates of the optical properties of the particles as functions of the concentration of non-volatile suspended solids, algal chlorophyll, and suspended detritus. The predictive value of the regression equations was tested using an independent data set. The methods developed appear to be well suited for the development of relationships between optical properties and particle characteristics and concentrations. (Humphreys-ISWS)
W79-04734

BEHAVIOR OF WATER IN VARIOUS STATES,
New Mexico Highlands Univ., Las Vegas.
J. A. Schufle, M. Venugopalan, R. Muller, and N-t Yu.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-184 075, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 262, July 1967. 51 p, 19 fig, 18 tab, 15 ref. 14-01-0001-610.

Descriptors: *Capillary conductivity, *Hydrologic properties, *Movement, *Activation energy, *Water properties, Computer programs, Correlation analysis, Least squares method, Water temperature, Physical properties, Research and development.

The activation energy of conduction of water in capillaries, and the specific volume of water in capillaries were studied. In Part I, the mechanism of proton transfer in aqueous solution is discussed. Conductivity experiments were carried out using an electrometer, capillaries of Pyrex stock tubing with platinum wire electrodes, and hydrogen chloride solutions. The results obtained are tabulated; they show that activation energy in capillaries 5 microns in diameter is increased approximately 50% over that obtained in bulk solutions for 10 to the minus 4 normal hydrogen chloride solutions. The research objective of Part II was to find a precise expression for the calculation of specific volume over the temperature range of -40C to +30C, and to obtain on estimate of the temperature corresponding to minimum specific volume, based on the measurements obtained from the research reported in Part I. Water remains relatively stable at temperatures down to the range of -30C to -40C when it is retained in capillaries with diameters of 10 microns of less. A computer program was developed in an analysis of the data. Some shift in the minimum volume from the normal at 4C to near 0C was evidenced. (Davison-IPA)
W79-04951

1B. Aqueous Solutions and Suspensions

ANALYSES OF WATER, CORE MATERIAL, AND ELUTRIATE SAMPLES COLLECTED NEAR YAZOO CITY, MISSISSIPPI, (YAZOO HEADWATER PROJECT),
Geological Survey, Baton Rouge, LA. Water Resources Div.
H. L. Leone, Jr., and A. J. Dupuy.
Geological Survey open-file report 78-792, August 1978. 10 p, 1 fig, 1 plate, 4 tab, 9 ref.

Descriptors: *Water analysis, *Water quality, *Core drilling, *Bottom sediments, *Chemical analysis, Heavy metals, Pesticides, Physical properties, Sediments, Particle size, Hydrologic data, Mississippi, *Predredging study, *Yazoo Headwater Project.

Five core-material-sampling sites near Yazoo City, Miss., were chosen by the U.S. Army Corps of Engineers to represent areas of proposed dredging activity. Four receiving-water sites also were selected to represent the water that will contact the proposed dredged material. Chemical and physical analyses were performed upon core material and native-water samples from these sites as well as upon elutriate samples of specific sediment-receiving water systems. The results of these analyses are presented without interpretation. (Woodard-USGS)
W79-04793

2. WATER CYCLE

2A. General

NITRATE AND PHOSPHORUS RUNOFF LOSSES FROM SMALL WATERSHEDS IN GREAT LAKES BASIN,
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
For primary bibliographic entry see Field 5C.
W79-04535

HYDROLOGIC IMPACT OF GRAZING SYSTEMS ON INFILTRATION AND RUNOFF: DEVELOPMENT OF A MODEL,
Utah State Univ., Logan. Coll. of Natural Resources.
R. H. Hawkins, and G. F. Gifford.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 528, Price codes: A02 in paper copy, A01 in microfiche. Utah State University, Hydrology and Hydraulics Series UWRL/H-79/01, January 1979. 14 p, 10 fig, 8 tab, 2 append. Utah Water Research Lab. OWRT A-035-UTAH(2), 14-34-0001-8047.

Descriptors: *Hydrologic models, Infiltration, Runoff, *Grazing, Computer programs.

The response of infiltration rate (fc) to grazing systems is modeled, based on infiltration-grazing information available from past studies. As inputs the model uses a grazing system schedule, initial infiltration rate, and a characteristic recovery time. The output is a sequence of infiltration rates, from which hydrologic impact inferences may be made. Background, development, usage, cautions, and future research needs are given. A computer program of the model is supplied.
W79-04585

A NONLINEAR ANALYSIS OF THE RELATIONSHIP BETWEEN RAINFALL AND RUNOFF FOR EXTREME FLOODS,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
C. C. Liu, and W. Brutsaert.
Water Resources Research, Vol. 14, No. 1, p 75-83, February 1978. 6 fig, 2 tab, 25 ref. OWRT-A-060-NY(2), 14-31-0001-5032, 14-34-0001-6033.

Descriptors: *Rainfall, *Runoff, *Floods, Floodwater, Precipitation intensity, Analytical techniques, Watersheds(Basins), Model studies, Volterra integral series, Galerkin-type method, Chebyshev polynomials.

The watershed response to heavy rainfall was considered as a hereditary process. A nonlinear system model was developed in terms of a Volterra integral series of the first kind, which satisfied the principle of dissipation of hereditary action as well as the requirement of time invariance. A workable and practical method was developed to compute optimal response or kernals of the two-term truncated Volterra series. A Galerkin-type method was used whereby the kernels were approximated by orthogonal function expansion in terms of Chebyshev polynomials.. The kernals evaluated from historical data for the Cowanesque watershed in the Chemung River basin were tested by reconstituting the hydrograph of an unrelated and unusual flood event caused by tropical storm Agnes of June 1972. It was found that the nonlinear watershed model yielded a better prediction of the hydrograph of an exceptional flood than the linear model. The performance of both nonlinear and linear models was sensitive to the assumed value of the rainfall loss rate. (Roberts-ISWS)
W79-04604

THE ARNO RIVER FLOOD STUDY (1971-1976),
Centro di Ricerca IBM di Pisa (Italy).
For primary bibliographic entry see Field 2E.
W79-04725

FACTORS AFFECTING THE EXPORT OF NITRATE-NITROGEN FROM DRAINAGE BASINS IN SOUTHERN ONTARIO,
York Univ., Toronto (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 5B.
W79-04735

DRAINAGE DENSITY AND STREAMFLOW: A CLOSER LOOK,
New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources.
For primary bibliographic entry see Field 2E.
W79-04736

APPLICATION OF THE FREQUENCY-EQUIVALENT NON-LINEAR HYDROGRAPH METHOD OF FLOOD FREQUENCY ANALYSIS IN URBAN BASINS,
Kansas Water Resources Research Inst., Manhattan.
R. L. Smith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 678, Price codes: A04 in paper copy, A01 in microfiche. Contribution No. 200, December 1978. 69 p, 21 fig, 17 ref. OWRT B-041-KAN(2), 14-34-0001-5075.

Descriptors: Urban hydrology, *Flood frequency, Unit hydrographs, *Rainfall frequency.

This project tested the application of the FENL-H methodology to urban basins. The methodology incorporates a non-linear modified rational formula approach for relating flood frequency to rainfall frequency. Specifically, the methodology utilizes the available rural data base to generate a frequency-equivalent storm and hydrograph. Transfer to urban basins is provided by assuming application of the same storm, but with adjustments of hydrograph volume in response to imperviousness and hydrograph time characteristics in response to the increase rate of rainfall excess. Forty Texas basins,

half urban and half rural, were used to test the concepts. Reasonably acceptable results were obtained in the calculations of the urban frequency curves. Attempts to reconstitute specific storm events were unsuccessful. Potential desirable changes in the methodology to overcome this difficulty are identified.
W79-04788

OPTIMAL SEQUENCE OF INCREMENTAL PRECIPITATION,
Bechtel, Inc., San Francisco, CA.
A. Prakash.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY12, Technical Note, p. 1668-1671, December 1978. 1 tab, 5 ref, 2 append.

Descriptors: *Rainfall-runoff relationships, *Hydrographs, *Maximum probable flood, *Mathematical models, Analytical techniques, Model studies, Precipitation(Atmospheric), Unit hydrographs, Flood peak, Discharge(Water), Runoff, Hydrograph analysis, Watersheds(Basins).

The objective was to present the methodology for development of the optimal sequence of a given hyetograph that would produce maximum flood peaks for specified unit hydrograph characteristics. To illustrate the difference in the peaks of runoff hydrographs obtained with the generalized and optimal sequences, computed values for three typical cases were tabulated. For convenience, the contributions of base flow and infiltration loss were neglected. Case 1 referred to a synthetically generated 2-hr unit hydrograph with an arbitrary pattern of storm bursts characterizing heavy rainfall regions. The optimal peak in this case is 8.75% higher than the peak obtained with the generalized sequence. Case 2 presented the 4-hr unit hydrograph of the North Branch of Potomac River near Cumberland, Maryland, with a meteorologically probable storm pattern. In this case, the difference in the two peaks was 2.12%. Case 3 illustrated the sequences of effective rain for a storm lasting longer than the base of the corresponding 1-hr unit hydrograph. The 2-hr and 6-hr maximum rainfalls in this case were, respectively, 1.78 and 2.48 times the 1-hr rainfall. It was shown that, depending upon the unit hydrograph and hyetograph pattern, the peak rate of runoff given by the optimal sequence can be considerably higher than that given by the commonly used generalized sequence. (Humphreys-ISWS)
W79-04901

2B. Precipitation

SOLAR ENERGY INFORMATION AND DATA FOR ILLINOIS,
Illinois State Water Survey, Urbana.
S. A. Changnon, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 712, Price codes: A04 in paper copy, A01 in microfiche. Circular 133, 1978. 63 p, 28 fig, 25 tab, 16 ref.

Descriptors: *Solar radiation, *Data collections, *Illinois, Radiation, Cloud cover, Seasonal, Spring, Summer, Winter, Autumn, Humidity, Air temperature, Wind velocity, Ice, Snow, Hail, Thunderstorms, *Solar energy.

This report was essentially a solar data compendium for Illinois. It contained a minimum of text and consisted mainly of tables and graphs, largely assembled from a wide variety of publications (many not easily found). It should be recognized that the designers and planners of solar energy systems will likely desire more data or some other form of solar information than that presented. Available radiation data are considered inadequate to describe the time-space variations in radiation and more measurements are needed. However, all available quality data in and around Illinois were used in the results shown, and users desiring different presentations or analyses of the data can, from this publication, be aware of where to procure available data on radiation, sunshine, temperature, and winds for different analyses. The information presented is largey based on averages for various records and periods (daily, weekly, monthly, and annually). Some extremes were presented where available. Also, where available, various probabilities of events (such as runs of days with sunshine or radiation) were given. The radiation data and information were presented first, followed by sections on sunshine and sky cover; then one on temperature, humidity, and winds; and finally one on weather hazards to solar energy systems. Selected data on basic weather factors that lead to energy demands also were presented. Average monthly values of temperatures (and extremes of temperature), relative humidity, and winds were offered for various state locales. Various weather conditions that will create problems for solar collectors were reviewed. Included were average and extreme values of hail, thunderstorms, pollution, snow, and ice, all presented to reveal the dimensions of these hazards. (Humphreys-ISWS)
W79-04719

INTERSTORM RELATIONS IN PACIFIC NORTHWEST,
National Weather Service, Silver Spring, MD. Office of Hydrology.
R. H. Frederick.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY12, Proceedings Paper 14255, p 1577-1586, December 1978. 5 fig, 3 tab, 10 ref, 1 append.

Descriptors: *Precipitation(Atmospheric), *Frequency, *Rainfall, *Washington, *Oregon, *Pacific Northwest US, Rainfall, Rainfall intensity, Precipitation intensity, Storms, Probability, Probable maximum precipitation, Temporal distributions, Duration curves, Design storm, Hydrology, Meteorology, Climatology, Data processing, Interstorm relations.

Annual maximum precipitation events for 1-hr, 2-hr, 3-hr, 6-hr, 12-hr, and 24-hr durations were identified. The concurrent event for each other duration was then selected. The relations between the annual maximum events and the concurrent rainfall for each other duration (which may or may not also be an annual maximum event) were studied. The interduration relations were shown to vary according to relative storm size and to be different in coastal and inland areas. A new method of developing mass precipitation curves for synthesized storms was proposed for use in hydrologic design and engineering studies. (Sims-ISWS)
W79-04733

BULK PRECIPITATION AND STREAMFLOW QUALITY RELATIONSHIPS IN AN URBAN AREA,
Tennessee Valley Authority, Knoxville.
For primary bibliographic entry see Field 2E.
W79-04738

SAMPLING AND CHEMICAL INTERPRETATION OF PRECIPITATION FOR MASS BALANCE STUDIES,
Colorado Univ., Boulder, Dept. of Environmental Population and Organismic Biology.
W. M. Lewis, Jr., and M. C. Grant.
Water Resources Research, Vol. 14, No. 6, p 1098-1104, December 1978. 2 fig, 1 tab, 53 ref.

Descriptors: *Sampling, *Precipitation(Atmospheric), *Water chemistry, *Equipment, Rainfall, Snowfall, Fallout, Chemical precipitation, Chemicals, Data collections, Chemical analysis, Bulk precipitation, Maso balance studies.

From an analytical viewpoint, total dry and wet precipitation consists of three fractions: (1) dissolved materials in aqueous precipitation, (2) the water-soluble component of dry precipitation, and (3) the water-insoluble component of either wet or dry precipitation. Methods of precipitation collection and processing greatly affect the separation of these components. A literature survey showed that fraction 3 typically has been ignored and that samplers currently in use lead to a highly variable mixture of three fractions. Major causes of interpretational ambiguity include: (1) variable leaching of dry fallout, (2) particle formation and chemical repartitioning in aqueous precipitation, (3) height, texture, and composition of the collector surfaces, (4) relation of collector surfaces to natural environmental surfaces, (5) contamination by birds, insects, pollen, and organometallic release from local vegetation, (6) sample storage, and (7) failure to analyze insoluble particles. A literature survey also showed that most collectors currently in use are of insufficient size to collect samples large enough to support broad-spectrum analysis on a weekly basis. The minimum satisfactory size of collectors was computed from: (1) average rain chemistry, (2) sensitivity of standard chemical tests for chemical species of biological interest and (3) volume required for each analysis. The computations showed that collectors should have an area of at least 1,200 sq cm in regions of average chemistry and as much as 8,300 sq cm in cold climates with minimal aqueous precipitation. A design was given for a collector which combines large size with other desirable features. (Sims-ISWS)
W79-04747

WINTER STORMS AND THE RECORD-BREAKING WINTER IN ILLINOIS,
Illinois State Water Survey, Urbana.
S. A. Changnon, Jr., and D. Changnon.
Weatherwise, Vol. 31, No. 6, p 219-225, December 1978. 4 fig, 3 tab, 4 ref.

Descriptors: *Storms, *Winter, *Snow, *Illinois, *Central U.S., Snowfall, Snow cover, Ice, Blizzards, Winds, Hazards, Distribution patterns, Precipitation(Atmospheric), Effects, Highways, Temperature, Air temperature, Climatology, Meteorology, *Winter storms, Severe winter storms, Snowstorms, Ice storms, Freezing rain.

The Midwest, including Illinois, experienced in 1977-1978 its most severe winter since weather records began in the early 19th century. The major impact in Illinois came from a record breaking number of 18 severe winter storms. In a normal year only 4 storms occur. The record winter began with three snowstorms in late November and ended with an extremely damaging ice storm in late March. Unusual snow patterns occurred with several storms and they lasted in Illinois much longer than usual. Weather conditions (low pressure centers) producing many of the storms were more often of Canadian origin than usual, and these lows had lower pressure and moved slower than normal, resulting in higher surface winds and longer lasting and hence more severe storms. Cold temperatures coupled with the frequent snowstorms resulted in record long lasting snow cover with up to 120 days with 1 inch or more cover in northern Illinois and 90 days in southern Illinois. The storms led to deaths of 62 persons and injuries to more than 2000. Utilities and communication systems suffered great losses due to damages to lines, poles, and towers. Transportation losses included damaged vehicles, delayed shipments, and great delays in bus and airline service; however, railroads benefited with increased usage and helicopters and snowmobiles proved valuable in rescue service. The local, state, and federal institutions were beset with enormous and costly problems including care of roads and lost taxable income due to absenteeism. (Sims-ISWS)
W79-04839

OPTIMAL SEQUENCE OF INCREMENTAL PRECIPITATION,
Bechtel, Inc., San Francisco, CA.
For primary bibliographic entry see Field 2A.
W79-04901

A NOTE ON THE DYNAMIC CALIBRATION OF TIPPING-BUCKET GAUGES,
Institute of Hydrology, Oxon (England).
I. R. Calder, and C. H. R. Kidd.
Journal of Hydrology, Vol. 39, No. 3/4, p. 383-386, December 1978. 2 fig, 3 ref.

Descriptors: *Calibrations, *Dynamics, *Gages, Flow, Flow rates, Precipitation(Atmospheric), Rainfall, Meteorology, Discharge, Hydrology, Rainfall intensity, *Dynamic calibration, Tipping-bucket, Flow meter, Static calibration, Non-linear relation.

This technical note was concerned with the use of tipping-bucket gages for the field measurement of flow rate or rainfall intensity. As a first approximation, a static calibration was assumed relating the flow rate to the bucket volume and the time between successive bucket tips. A non-linear relation exists between flow rate and the tipping rate of a tipping-bucket gage because a variable quantity of water, depending on the flow rate, is lost during the time taken for the bucket to move from rest to the position at which the central bucket division is beneath the inlet stream of water. It was determined that such gages should be calibrated individually for both bucket volume and the time between successive bucket tips since these parameters vary in response to changes in a number of variables, chiefly the height of the bucket stops and the resistance of the bearings. (Roberts-ISWS)
W79-04903

2C. Snow, Ice, and Frost

SOLAR ENERGY INFORMATION AND DATA FOR ILLINOIS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2B.
W79-04719

IS THE SOIL FROZEN OR NOT. AN ALGORITHM USING WEATHER RECORDS,
Science and Education Administration, Kimberly, ID. Snake River Conservation Research Center.
For primary bibliographic entry see Field 2G.
W79-04740

SATELLITE SNOW-COVER OBSERVATIONS IN ARIZONA,
Geological Survey, Phoenix, AZ. Water Resources Div.
For primary bibliographic entry see Field 7B.
W79-04803

TIME-DEPENDENCE OF SEA-ICE CONCENTRATION AND MULTIYEAR ICE FRACTION IN THE ARCTIC BASIN,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center; and Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 7B.
W79-04811

2D. Evaporation and Transpiration

MEASUREMENT OF EVAPORATION FROM LAKES AND PONDS IN FLORIDA,
Florida Univ., Gainesville. Dept. of Fruit Crops.
J. F. Bartholic, R. G. Bill, Jr., and L. H. Allen, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 561, Price codes: A05 in paper copy, A01 in microfiche. University of Florida Water Resources Research Center Publication No. 43, 1978. 81 p, 28 fig, 5 tab, 49 ref. OWRT A-031-FLA(2). 14-34-0001-8010.

Descriptors: *Evaporation, Lakes, Bowen ratio, Turbulent flux.

Hydrological models often calculate evaporation in terms of corrections to evaporation pan data. A more satisfactory approach would be to estimate evaporation rates in terms of the turbulent transport processes which govern the diffusion of water vapor in the atmospheric boundary-layer. Turbulent diffusion is evaluated through the use of (1) the Bowen ratio energy method, (2) numerical simulations of the atmosphere, (3) the eddy correlation technique, and (4) bulk transfer coefficients. Instrumentation to measure the Bowen ratio was adapted to measure latent and sensible heat fluxes from Lake Apopka. In addition to the measurement of energy fluxes from Lake Apopka, thermal imagery indicated the downwind distance for which thermal effects due to the lake were significant. These observations suggested that the atmospheric model of Gutman (1974) would adequately model the transport of energy from Lake Apopka. Direct measurements of evaporation on Orange Lake are reported. The eddy correlation technique was employed using an ultra-sonic anemometer thermometer and a Lyman-alpha humidity sensor. Results were compared with bulk transfer coefficients, as well as a new relationship by Hicks (1975) which predicts fluxes solely on the basis of surface temperature. Finally, bulk transfer coefficients are used to predict the diurnal variation in the flux of latent heat from East Lake Tohopekeliga.
W79-04583

A SIMPLIFIED MODEL OF CORN GROWTH UNDER MOISTURE STRESS,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
S. W. Childs, J. R. Gilley, and W. E. Splinter.
Transactions of the American Society of Agricultural Engineers, Special Edition, Vol. 20SW, p 858-865, October 20, 1977. 7 fig, 3 tab, 21 ref. OWRT A-038-NEB(3), 14-34-0001-7058.

Descriptors: *Mathematical models, *Soil moisture, *Corn, Transpiration, Soil-plant-water relationships, Evaporation, Plant growth, Crop production, Nebraska, Water conservation, Hydraulic conductivity.

A mathematical model was developed to simulate the environmental and physiological processes involved in the growth of corn. Grain yields were accurately predicted even where inadequate irrigation caused decreased yield. Some predictions of crop growth patterns indicated that all of the dynamics of crop growth are not yet modeled in sufficient detail. However, the accuracy of growth trends in general indicate that the model has considerable predictive power. (Skogerboe-Colorado State)
W79-04607

ESTIMATING EVAPOTRANSPIRATION RATES FOR CORN IN DELAWARE,
Delaware Univ., Newark. Dept. of Agricultural Engineering.
W. F. Ritter, T. H. Williams, and R. P. Eastburn.
Paper No. 78-2029, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah. 27 p, 17 fig, 1 tab, 11 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Evapotranspiration, Humid climates, *Corn, Growth stages, Consumptive use, Delaware.

The Jensen-Haise, Penman, pan evaporation and Thornthwaite methods were used to predict evapotranspiration. All methods underestimated the measured peak ET rates. The critical moisture period for corn was from the 14th leaf stage to beginning dent. (Skogerboe-Colorado State)
W79-04988

2E. Streamflow and Runoff

METHODOLOGY FOR EVALUATION OF FEASIBILITY: MULTIJURISDICTIONAL URBAN DRAINAGE AND FLOOD CONTROL PROJECTS.
Urban Drainage and Flood Control District, Denver, CO.
For primary bibliographic entry see Field 6F.
W79-04502

A NONLINEAR ANALYSIS OF THE RELATIONSHIP BETWEEN RAINFALL AND RUNOFF FOR EXTREME FLOODS,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2A.
W79-04604

THE ARNO RIVER FLOOD STUDY (1971-1976),
Centro di Ricerca IBM di Pisa (Italy).
L. Panattoni, and J. R. Wallis.
EOS Transactions, American Geophysical Union, Vol. 60, No. 1, January 2, 1979. 5 p, 10 fig, 1 tab, 10 ref.

Descriptors: *Flood waves, *Flood forecasting, *Model studies, Floods, Historic floods, Flood recurrence interval, Flood routing, Storm runoff, Computer models, Foreign countries, Foreign research, *Italy, *Arno River(Italy).

The Arno River in Italy intermittently inundates large areas of the Arno River basin. This paper investigated flood phenomena and evaluated some of the proposals that have been made to alleviate the flood hazard using procedures developed at the IBM Pisa Scientific Center. The Arno River basin has an area of about 8,229 sq km with a main channel of approximately 245-km length. The completed model was tested on three of the larger historic floods that were not used for calibration of the model, the floods of 1951, 1960, and 1968. The predicted flood waves were made on the basis of the precipitation data for the events and the previously calibrated model, that is, no on-line updating of model predictions was involved. For comparison purposes, the measured flood heights and the predicted values were comparatively good for the 1951 and 1960 flood events and much less good for the 1968 event. (Humphreys-ISWS)
W79-04725

TEMPORAL MOMENTS FOR LONGITUDINAL DISPERSION,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W79-04732

DRAINAGE DENSITY AND STREAMFLOW: A CLOSER LOOK,
New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources.
S. L. Dingman.
Water Resources Research, Vol. 14, No. 6, p 1183-1187, December 1978. 2 fig, 4 tab, 25 ref.

Descriptors: *Drainage density, *Streamflow, *Thalweg, Watershed(Basins), Channels, Geomorphology, Hydrology, Groundwater, Mathematical studies, Density, Flow, *Drainage efficiency, Hortonian overland flow.

Drainage density D was defined by Horton as D = L/A, where L is the total length of stream thalwegs in an area of size A. Because the average distance from watershed divide to channel is approximately 1/2D, D often has been used as a measure of drainage efficiency and, hence, as an independent variable for predicting a wide variety of streamflow characteristics in ungaged watersheds. However, 'effective drainage density' D sub E = L sub V/A, where L sub V is the total length of stream valleys, is a better characterization of divide-to-channel distance than D. Furthermore, in Hortonian overland flow, D sub E (or approximately D) is only one of several factors affecting drainage efficiency, and its influence can be readily overridden. In saturation overland flow, neither D sub E nor D is fundamentally related to drainage efficiency, though they may proxy for more fundamental parameters. In groundwater flow, drainage efficiency is proportional to D sub E; thus higher flow variability will tend to be correlated with higher D sub E. The proportions of groundwater runoff and storm runoff from a watershed are not fundamentally related to D or D sub E, regardless of mode of flow. These theoretical conclusions were supported by close examination of previous studies relating drainage density to hydrologic variables and indicated that D sub E(or D) is of much more limited value as an independent variable for

predicting hydrologic characteristics than has been assumed in the literature. (Lee-ISWS)
W79-04736

BULK PRECIPITATION AND STREAMFLOW QUALITY RELATIONSHIPS IN AN URBAN AREA,
Tennessee Valley Authority, Knoxville.
R. P. Betson.
Water Resources Research, Vol. 14, No. 6, p 1165-1169, December 1978. 5 tab, 20 ref.

Descriptors: *Tennessee, *Water quality, *Precipitation(Atmospheric), Urban runoff, Urban hydrology, Small watersheds, Urban drainage, Streamflow, Cities, Effects, *Bulk precipitation, Streamflow water quality.

A systems study of urban hydrology was undertaken in Knoxville, Tennessee. Measurements of bulk precipitation quality were related to streamflow quality in several small watersheds. The yields of streamflow in these catchments are affected to varying degrees because they are located in carbonate terrain. Compared with bulk precipitation concentrations measured in other urban areas and in rural areas, the quality of bulk precipitation in Knoxville was found to be similar to that measured elsewhere for some 20 constituents. Input-output studies for various constituents revealed that the relationships were influenced considerably by the effect of subdrainage losses through the carbonate rock system and by urbanization. In each case, however, the atmosphere was found to provide important sources for many constituents. Comparisons of the water quality data with those from equivalent rural areas revealed the quality of these urban streams to be similar to rural streams. These findings led to the conclusion that bulk precipitation may be an important source for many constituents found in streamflow from rural and urban areas. (Lee-ISWS)
W79-04738

THE INCOMPLETE MEANS ESTIMATION PROCEDURE APPLIED TO FLOOD FREQUENCY ANALYSIS,
Massachusetts Inst. of Tech., Cambridge. Energy Lab.
J. C. Houghton.
Water Resources Research, Vol. 14, No. 6, p 1111-1115, December 1978. 2 fig, 1 tab, 6 ref, 1 append.

Descriptors: *Flood frequency, *Model studies, *Mathematical models, Floods, Flood forecasting, Damages, Mathematics, Statistics, Statistical models, Monte Carlo method, Equations, Analytical techniques, Flood flow, Hydrology, Wakeby distribution.

A new estimation procedure to predict the size of a design event, given a past flood record, was found to be superior to various alternative fitting procedures. The 'incomplete means' method uses no moments higher than the first, a procedure which results in little bias. Although the fitting procedure can be applied to any distribution, it was tested by using a variant of the Wakeby distribution. Using a small Monte Carlo experiment with a single parent distribution, the incomplete means method applied to the logs of the observations results in less regret than other fitting procedures tested. A regret model was developed which introduces a design event based on the density function as an alternative to the more traditional T-year event. (Sims-ISWS)
W79-04741

BIRTH OF A PARENT: THE WAKEBY DISTRIBUTION FOR MODELING FLOOD FLOWS,
Massachusetts Inst. of Tech., Cambridge. Energy Lab.
J. C. Houghton.
Water Resources Research, Vol. 14, No. 6, p 1105-1109, December 1978. 3 fig, 1 tab, 9 ref.

Descriptors: *Flood flow, *Flood frequency, *Model studies, Mathematical models, Floods, Flood forecasting, Distribution patterns, Mathematics, Computer models, Statistics, Hydrology, *Wakeby distribution.

Traditional distributions, such as the log normal distribution, inadequately model flood flows for certain records. The Wakeby distribution was defined to overcome this deficiency, and its analytical form proved easy to use in many applications. Tests showed that a significant number of flood records are inadequately fit by the three-parameter log normal. The Wakeby demonstrated the 'separation effect' that other distributions fail to show. Most other distributions can be mimicked by the Wakeby but not always vice versa. Thus, choosing to use the Wakeby does not limit the shape of the resulting curve to as great a degree as choosing a conventional distribution. (Sims-ISWS)
W79-04742

CHANNELIZATION AND INVERTEBRATE IN SOME IOWA STREAMS,
Iowa State Univ., Ames.
D. W. Zimmer, and R. W. Bachmann.
Water Resources Bulletin, Vol. 14, No. 4, p 868-883, August 1978. 7 fig, 3 tab, 24 ref.

Descriptors: *Streams, *Channelization, Des Moines River(Iowa), *Invertebrate drift, Aquatic insects, Water level.

Habitat diversity and invertebrate drift were studied in a group of natural and channelized tributaries of the upper Des Moines River during 1974 and 1975. Channelized streams in this region had lower sinuosity index values than natural channel segments. There were significant ($P=0.05$) positive correlations between channel sinuosity and the variability of water depth and current velocity. Invertebrate drift density, expressed as biomass and total numbers, also was correlated with channel sinuosity. Channelization has decreased habitat variability and invertebrate drift density in streams of the upper Des Moines River Basin and probably has reduced the quantity of water stored in streams during period of low flow. (Bell-Graf-Cornell)
W79-04789

FLOOD-PLAIN DELINEATION FOR HORSEPEN RUN, SUGARLAND RUN, NICHOLS RUN, AND POND BRANCH BASINS, FAIRFAX COUNTY, VIRGINIA,
Geological Survey, Richmond, VA. Water Resources Div.
P. L. Soule.
Geological Survey open-file report 78-1028, 1978. 97 p, 59 fig, 12 tab, 4 ref.

Descriptors: *Flood profiles, *Streamflow, *Flood frequency, *Flood plains, *Flood forecasting, Flood routing, Floodways, Design flood, Flood control, Flood protection, Virginia, *Fairfax County, *Flood-plain mapping.

Water-surface profiles of the 25-, 50-, and 100-year recurrence interval discharges have been computed for all streams and reaches of channels in Fairfax County, Virginia, having a drainage area greater than 1 square mile except for Dogue Creek, Little Hunting Creek, and that portion of Cameron Run above Lake Barcroft. Maps have a 2-foot contour interval and a horizontal scale of 1 inch equals 100 feet were used for base on which flood boundaries were delineated for 25-, 50-, and 100-year floods to be expected in each basin under ultimate development conditions. This report is one of a series and presents a discussion of techniques employed in computing discharges and profiles as well as the flood profiles and maps on which flood boundaries have been delineated for the Horsepen Run, Sugarland Run, Nichols Run, and Pond Branch basins in Fairfax County. (Woodard-USGS)
W79-04801

U.S. GEOLOGICAL SURVEY'S ROLE IN THE COLLECTION AND ANALYSIS OF PEAK-FLOW DATA ON THE ISLAND OF OAHU, HAWAII,
Geological Survey, Honolulu, HI. Water Resources Div.
R. Lee.
In: Proceedings of Workshop on Storm Drainage Management, Honolulu, Hawaii, January 17-18, 1978. p B1-B6, (no date).

Descriptors: *Floods, *Peak discharge, *Flood recurrence interval, *Hawaii, *Flood forecasting, Analytical techniques, Streamflow, Hydrologic data, Regression analysis, Channel morphology, Drainage area, Topography, Vegetation, Evaluation, *Island of Oahu.

With the accumulation of the peak-flow data that the Geological Survey has collected in its cooperative program with the city and county of Honolulu and the much longer program with the State of Hawaii, it is possible to evaluate the magnitudes and frequencies of future floods on Oahu. The multiple regression technique was used to relate peak discharges of various recurrence intervals to basin and climatic characteristics. Some of the basin and climatic characteristics used were drainage area, channel slope, channel length, mean basin elevation, forest cover, and mean annual precipitation. The recurrence intervals of peak flows ranged from 2 to 100 years. Many options of grouping the stations were tried. The groupings were by geographic location, elevation, size of drainage area, or a combination of these. The option which gave the best standard error of estimate in the results was one that divided the stations into five groups according to size of drainage area. (Woodard-USGS)
W79-04812

FLOOD PLAIN INFORMATION: BIG THOMPSON RIVER, WELD COUNTY, COLORADO,
Army Engineer District, Omaha, NE.
Prepared for Weld County Larimer-Weld Regional Council of Governments and Colorado Water Conservation Board, Feb. 1978. 33 p, 8 fig, 28 plates, 6 tab.

Descriptors: *Colorado, *Flooding, *Flood data, *Peak discharge, *Flood peak, *Big Thompson River(CO), *Weld County(CO), Floods, Overland flow, Indirect flood measurement, Flood forecasting, Historic floods, Flood frequency, Flood stages, Stage-discharge relations, Flood damage, Rivers, Flood plains, Non-structural alternatives, Warning systems, Land use, Control structures, 100-year flood, 500-year flood.

The study area is the Big Thompson River basin in Weld County, Colorado. This basin drains an area of about 830 square miles in North Central Colorado. The most common form of development in the flood plain within the study area is agriculture, but overall development is relatively sparce. Flood data were gathered from 2 U.S. Geological Survey gaging stations, Corps of Engineer's flood records, topographic maps, and local newspaper. Intense rainfall of cloudburst magnitude occurs in the area. Floods generally occur from May through July, but peak discharges have been recorded from March through September. No effective flood control structres have been constructed. Olympus Dam, located in the upper part of the river basin, has negligible effect in reducing flood damages. The worst recorded flood near the Drake gaging station occurred in July 1976, discharging 31,200 cubic feet per second (CFS). The Intermediate Regional Flood at the Larimer-Weld County line would discharge 10,000 CFS, while Standard Project Flood (SPF) at the same location would discharge 18,500 CFS. Downstream from Little Thompson River the SPF would discharge 20,000 CFS. This report was prepared as an aid to local officials in planning the use and regulation of the flood plain. (Coan-NC)
W79-04854

FLOOD PLAIN INFORMATION: TCHEFUNCTA RIVER AND TRIBUTARIES, COVINGTON, LA.
Army Engineer District, New Orleans, LA.
Prepared for St. Tammany Parish, November 1971. 71 p, 26 fig, 27 plates, 16 tab.

Descriptors: *Louisiana, *Flooding, *Flood data, *Flow duration, *Stage-discharge relations, *Covington(LA), *Tchefuncta River(LA), Floods, Indirect flood measurement, Flood forecasting, Flood profiles, Historic floods, Flood recurrence interval, Flood stages, Peak discharge, Flood peak, Flow characteristics, Flood damage, Flood protection, Warning systems, Control structures, Channel improvement, Standard Project Flood, Intermediate Regional Flood, St. Tammany(LA), Bogue Falaya River(LA).

The study area includes the Tchefuncta River flood plain in the vicinity of Covington, Louisiana and the flood plains of its major tributaries, Bogue Falaya and Little Bogue Falaya Rivers. Residential developments, small farms, and businesses are scattered throughout the flood plain in the study area. Flood data were gathered from 2 stream gages, U.S. Geological Survey surveys, historical documents, and newspaper files. The only flood damage prevention measure was built in the 1880's and is a channel improvement project on the Tchefuncta and Bogue Falaya Rivers. There are no flood plain regulations presently operating in Covington. The main flood season occurs in winter and spring but intense local thunderstorms can cause flooding in the summer. Flooding occurs primarily from heavy rainfall. The greatest flood at Covington occurred in May 1953, reaching a peak discharge of 14,800 cubic feet per second (cfs). Another large flood, in November 1961, discharged 14,000 cfs at the same location. The peak discharge for the Intermediate Regional Flood on the Tchefuncta River at U.S. Highway 190 would be 22,200 cfs, with an elevation of 30.5 feet above mean sea level (msl). The Standard Project Flood would discharge 40,100 cfs with an elevation of 32.5 msl. Flood profiles are also presented for Bogue Falaya and Little Bogue Falaya Rivers. Several bridges in the study area are obstructive to flood flows. The purpose of this report is to provide a basis for further study and planning in arriving at solutions to minimize vulnerability to flood damages through possible structural and non-structural measures. (Coan-NC)
W79-04855

THE RIVER'S REACH: A UNIFIED PROGRAM FOR FLOOD PLAIN MANAGEMENT IN THE CONNECTICUT RIVER BASIN.
New England River Basins Commission, Boston, MA.
For primary bibliographic entry see Field 4A.
W79-04857

FLOOD HAZARD ANALYSES: WASHITA RIVER, RAINY MOUNTAIN CREEK, MOUNTAIN VIEW AND VICINITY, KIOWA COUNTY, OK.
Soil Conservation Service, Stillwater, OK.
Prepared for Town of Mountain View and Mountain View Soil Conservation District, OK, September 1977, 20 p, 8 fig, 14 plates, 19 ref, 3 appendices.

Descriptors: *Indirect flood measurement, *Historic floods, *Flood frequency, *Flood recurrence interval, *Flood plain management, *Washita River(OK), *Rainy Mountain Creek (OK), *Mountain View(OK), *Flood forecasting, *Flood profiles, Floodwater, Flooding, Regional flood, Annual flood, Streamflow forecasting, Maximum probable flood, Flood data, Flood stages, Stage-discharge relations, Rivers, Flood plains, Flood protection, Land use, Zoning, Control structures, Reservoirs, Water storage, Kiowa County(OK).

Mountain View, OK, lies near the confluence of the Washita River and Rainy Mountain Creek in northeastern Kiowa County. Most of the land use in the Rainy Mountain Creek watershed is agricultural. The study area covers 2.6 square miles. A U.S. Geological Survey stream gage is maintained on the Washita River approximately 20 miles below its confluence with Rainy Mountain Creek. Although normal discharge of the Creek is between 2,000 and 4,000 cubic feet per second (cfs), major floods with flows exceeding 10,000 cfs have occurred at three times per decade since 1921, with the most recent recorded flood in September 1965 discharging 17,400 cfs, and reaching a gage height of 23.5 ft. The largest flood occurred in May 1944, discharging 50,000 cfs, reaching a height of 26.2 ft. Estimates of floodwater surface elevation vary from 1,325.9 ft (10-year frequency) to 1,332.8 ft (500-year frequency). Events leading up to and including the 100-year occurrence would result largely in damage to crops, pastures, livestock, and some isolated farm structures. Flood plain management techniques are presented. Recommendations include updating and revising current flood prone area designations using existing Flood Hazard Boundary Maps, using zoning regulations to develop a basin master land use plan, soliciting support for current watershed flood control, and agricultural conservation measure programs. Also recommended is the establishment of a floodway area in which outdoor recreation activities are encouraged. Development of the flood fringe area should only occur if substantial floodproofing measures are taken. (Arnold-NC)
W79-04860

FLOOD PLAIN INFORMATION: CALCASIEU RIVER, OAKDALE, LOUISIANA.
Army Engineer District, New Orleans, LA.
Prepared for the City of Oakdale, LA, August 1968. 54 p, 6 fig, 19 plates, 12 tab.

Descriptors: *Louisiana, *Flooding, *Calcasieu River(LA), *Oakdale(LA), *Flood data, *Peak discharge, Floods, Indirect flood measurement, Flood forecasting, Flood profiles, Historic floods, Flood recurrence interval, Flood stages, Flood peak, Flow duration, *Stage-discharge relations, Flood protection, Warning systems, Control structures, Levee, Glenmora(LA), Standard Project Flood, Intermediate Regional Flood.

The study area includes the city of Oakdale, Louisiana and surrounding land located in the flood plain of the Calcasieu River. The major residential developments of Oakdale are on high ground east of the Calcasieu River, but some residential and commercial development is in the flood plain. There are no discharge records of the Calcasieu River at Oakdale, but gaging stations exist in the surrounding area. Flood data were obtained from local residents, historical documents, and newspaper files. There are no existing or proposed flood control measures, nor are there any flood plain regulations in Oakdale. The main flood season is in winter and spring, and flooding results primarily from heavy rains. The highest recorded flood in the study area occurred in May 1953, reaching an elevation of 105.6 feet above mean sea level (msl) and discharging 66,200 cubic feet per second (cfs). This flood remained above bankfull stage for about 7 days. At State Highway 10 in Oakdale, the Intermediate Regional Flood is estimated to have a peak discharge of 67,100 cfs and a channel velocity of 7.1 feet per second. The Standard Project Flood would have a peak discharge of 84,900 cfs and a channel velocity of 8.1 feet per second. This report is intended to aid in the solution of local flood problems and in the best utilization of lands subject to overflow. (Coan-NC)
W79-04861

FLOOD HAZARD STUDY: BARK RIVER, VILLAGE OF DOUSMAN AND VICINITY, WAUKESHA COUNTY, WISCONSIN.
Soil Conservation Service, Madison, WI.
June, 1978. 22 p, 5 fig, 4 plates, 20 ref.

Descriptors: *Wisconsin, *Floods, *Flood plains, *Bark River(WI), *Flood protection, Flood flow, River flow, Flood frequency, Rivers, Dousman(WI), Flood plain zoning, Flood plain insurance, Building codes, Planning, Zoning, Levee, Dikes, Reservoirs, Channel improvement, 100-year flood.

This flood hazard report identifies areas subject to flooding by the Bark River in the vicinity of the town of Dousman, in Waukesha County, in the Rock River Valley of Southeastern Wisconsin. The drainage area of the Bark River above Dousman is approximately 58 square miles. The area is mainly agricultural with some urban development in incorporated areas. The watershed is generally flat and Dousman is subject to flooding by the Bark River. No major recent floods have been reported. Expected flood levels for the 100-year flood are presented at four bridge crossings. The 100-year flood is expected to reach a level of 861 feet mean sea level, with velocities ranging from 0.8 to 1.5 feet per second. Flood plain management options are suggested--planning programs and zoning and subdivision ordinances, with a list of 11 possible non-structural alternatives combined with structural flood protection works such as reservoirs, levees and dikes, pumps, channel modification and floodproofing. The report recommends purchase of flood insurance by all who live in the flood hazard area and the development of a local floodplain management program in cooperation with the Wisconsin Department of Natural Resources. (Arnold-NC)
W79-04863

SPECIAL FLOOD HAZARD INFORMATION: FRANKLIN, LOUISIANA AND VICINITY, YOKELY BAYOU AND BAYOU TECHE.
Army Engineer District, New Orleans, LA.
Prepared for City of Franklin, LA, March 1978. 25 p, 8 fig, 20 plates, 3 tab.

Descriptors: *Louisiana, *Flooding, *Flood profiles, *Hurricanes, *Flood data, *Franklin(LA), *Bayou Teche(LA), *Yokely Bayou(LA), Floods, Indirect flood measurement, Storms, Historic floods, Flood recurrence interval, Flood stages, Flow characteristics, Flood protection, Non-structural alternatives, Warning systems, Control structures, Levees, Locks, Channel improvement, 100-year flood.

The study area includes the city of Franklin, LA and surrounding land within the vicinity of Yokely Bayou and Bayou Teche. Both flood plains contain scattered residential and commerical development, but most of the properties are used for farming and grazing. Flood data were gathered from the National Weather Service, U. S. Geological Survey records, interviews with local residents, historical documents, and local newspaper files. The Charenton Drainage Canal was constructed after the 1927 flood. It is part of the Mississippi River and Tributaries Flood Control Project and is the major structural flood reduction measure in the study area and along with levees provides protection up to a 300-year hurricane. There are no zoning ordinances, building codes, or other regulatory measures specifically for the reduction of flood damages. Flooding along Bayou Teche and Yokely Bayou occurs primarily from hurricanes and heavy rainfall, occurring from June through October. Flood data on stage-discharge relationships do not exist for the study area. Some minor flooding occurred as a result of Hurricane Hilda in 1964, but no damaging floods have occurred since the 1927 flood. No records of discharge are available for that flood. The most serious flood threat in the future is from hurricane surges overtopping the protective levees west and south of Franklin. This report furnishes a suitable basis for the adoption of land use controls to guide flood plain development. (Coan-NC)
W79-04864

FLOOD PLAIN INFORMATION: SALT CREEK - VICINITY OF PUEBLO, COLORADO.
Army Engineer District, Albuquerque, NM.
Prepared for City and County of Pueblo, CO., April 1976. 30 p, 4 fig, 21 plates, 4 tab.

Descriptors: *Colorado, *Flooding, *Flood protection, Floods, Indirect flood measurement, Flood forecasting, Flood profiles, Flood stages, Peak discharge, Flood peak, Stage-discharge relations, Rivers, Floodways, Standard Project Flood, Non-structural alternatives, Warning systems, Building codes, Land use, Planning, Control structures, Floodproofing, *Flood plain zoning, *Zoning, *Salt Creek(CO), *Pueblo(CO), *Flood plain management, Intermediate Regional Flood.

Salt Creek is a right bank tributary to the Arkansas River, with its confluence being located in the

southeast corner of the city of Pueblo, Colorado. The Salt Creek watershed is a flood prone area, containing 37.2 square miles. The creek flows through the residential and major industrial areas of southeast Pueblo and is used as the runoff channel for the St. Charles Flood Ditch. The CF&I Steel Corporation has erected two large reservoirs on the creek to provide water for their industrial processes. There are no stream gages in the study area. Information on past floods was found in historical documents and newspaper files. Discharge data are provided for other streams in the Pueblo area. Flood producing storms over the Salt Creek watershed occur from May through August. Several large highway bridges and smaller railroad bridges are obstructive to floods. One reservoir in the area is effective in reducing flood flow. The Intermediate Regional Flood would have a peak discharge of 9,182 cubic feet per second (cfs) rising 8.5 feet; the duration of flooding is expected to be 18 hours. A peak discharge of 15,129 cfs is estimated for the Standard Project Flood, rising to a height of 11.0 feet and lasting for 21 hours. The report describes guidelines for flood plain management and provides data for locating and designing various structures and channel improvements, and establishing criteria for floodproofing. (Coan-NC)
W79-04865

FLOOD HAZARD ANALYSES: MCKENZIE RIVER, HEDRICKS BRIDGE TO LEABURG DAM, LANE COUNTY, OREGON.
Soil Conservation Service, Portland, OR.
July 1978. 87 p, 2 fig, 62 plates, 1 tab, 17 ref, 8 append.

Descriptors: *Floods, *Flood profiles, *Flood data, *McKenzie River(OR), *Flood plain management, *Flood protection, Flooding, Annual flood, Flood frequency, Flood plains, Lane County(OR), Flood plain zoning, Flood plain insurance, Building codes, Land use, Planning, Zoning, Control structures, Flow control, Levee, Dikes, Reservoirs, Water storage, Channel improvement, Floodproofing, *Oregon, Rivers.

These flood hazard analyses were carried out to identify areas subject to flooding in the McKenzie River drainage area lying on the western slopes of the Cascade Mountain Range in the central portion of western Oregon. The study area is in Lane County, approximately 13 miles east of Eugene. Three villages are within the area, with farms located throughout the length of the valley. The area is mainly agricultural but pressure for residential development is increasing. Most flooding occurs in the winter months, November-March, resulting from heavy rains and snowmelt. Three dams and reservoirs have been constructed in the upper portions of the McKenzie River Valley, reducing the flood potential. A devastating flood in 1964 would have resulted in far greater damage without these dams. This flood approximated a 200-year event. A floodplain zoning ordinance is in effect for Lane County. Floodplain management techniques are discussed, including provision for a floodway, divided into a 'floodway' and 'floodway fringe' area. Detailed maps depicting flood hazard areas are accompanied by flood hazard profiles of Stage 2 conditions on the river. The report recommends that its findings be used as a floodplain management tool by Lane County; that regulations compatible with National Flood Insurance Guidelines be adopted; that new development in the villages of Waterville, Deerhorn, and Leeburg be controlled to avoid damage by the 100-year flood; and that a major floodplain on the north side of the McKenzie River remain in agricultural use to avoid flood damage. (Arnold-NC)
W79-04866

DISAGGREGATION OF STREAMFLOW VOLUMES,
Hokkaido Univ., Sapporo (Japan). Dept. of Civil Engineering.
K. Hoshi, and S. Burges.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY1, Proceedings Paper 14331, p 27-41, January 1979. 2 fig, 4 tab, 25 ref, 2 append.

Descriptors: *Streamflow, *Model studies, *Hydrology, Probability, Hydraulic models, Stochastic processes, Mathematical studies, Aggregates, Flow, Seasonal, Monthly, Annual, *Probability theory, Aggregation, Aggregation model.

A disaggregation model, which differs from those developed by Valencia and Schaake (VS) and Mejia and Rousselle (MR) (referred to as the HB model), was developed specifically to preserve correlations between seasons joining water years in addition to the properties preserved by the basic VS model. The HB model simultaneously disaggregates two consecutive annual flow volumes, then the next two, etc. The HB model is extended to be able to disaggregate skewed seasonal flows that follow three-parameter log-normal distributions (3PLN). Mixtures of skewed and nonskewed seasonal flow volumes are approximated by 3 PLN distributions for operational convenience. Practical considerations concerning use of these models for multisite flow disaggregation were reviewed, together with computational space requirements and limitations on model computability. A HB 3PLN model for single-site flow disaggregation was used in an example application where comparisons were made with the MR model. (Lee-ISWS)
W79-04878

WALNUT CREEK CHANNEL IMPROVEMENT PROJECT, CONTRA COSTA COUNTY, CALIFORNIA; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
J. F. George.
Technical Report H-78-14, July 1978. 84 p, 5 tab, 25 photos, 14 pl.

Descriptors: *Channel improvement, *Flow characteristics, *Flood control, *Energy gradients, Hydraulic models, *Walnut Creek(CA).

Tests were conducted on a 1:25-scale model of the covered channels in the city of Walnut Creek where Las Trampas Creek and San Ramon Creek join to form Walnut Creek. The capacity of the existing flood-control channel system was investigated, along with methods for increasing the capacity and improving flow characteristics in the channels. The model was constructed so the slopes of the channels could be adjusted to reproduce various energy gradients resulting from roughness values different than anticipated. Slopes of the model were initially adjusted to produce an energy gradient resulting from a Manning's roughness factor n of 0.012 in the prototype. Maximum discharge capacities were: Las Trampas Creek, 11,000 cfs (100-year frequency flow); San Ramon Creek, 17,400 cfs (2,200 cfs more than the 100-year frequency flow); Walnut Creek conduit, 24,000 cfs. A soffit installed on the bottom of the T-beams on the roof of Walnut Creek increased its capacity to 27,500 cfs. The slopes were readjusted to produce an energy gradient for roughness values that varied from 0.012 to 0.014 and changes in maximum discharge capacities were noted. A new transition design in Las Trampas Creek conduit increased the capacity of the conduit to 11,000 cfs. (WES)
W79-04923

2F. Groundwater

IMPROVEMENT OF THE STEADY FLOATING RANDOM WALK MONTE CARLO METHOD NEAR STRAIGHT LINE AND CIRCULAR BOUNDARIES WITH APPLICATION TO GROUNDWATER FLOW,
Kansas Water Resources Research Inst., Manhattan.
J. H. Turner, L. C. Burmeister, and D. W. Green.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 560, Price codes: A06 in paper copy, A01 in microfiche. Contribution No. 198, December 1978. 101 p, 34 fig, 18 ref, 6 append. OWRT B-045-KAN(1). 14-34-0001-6079.

Descriptors: *Mathematical models, *Monte Carlo method, *Groundwater movement, Groundwater models, Probabilistic models.

Monte Carlo procedures for solving the diffusion equation of heat conduction and flow through porous media have been known for some years. Various investigators have indicated that the so-called floating random walk Monte Carlo procedure offers advantages in terms of computer execution time for single point solutions and complex geometries over finite difference procedures. This work investigates an improvement to the floating random walk. The improvement is based upon the use of exact analytical solutions to the diffusion equation interpreted in probabilistic form. A comparison is made for a number of test cases between what is referred to as a conventional Monte Carlo procedure and the improved Monte Carlo procedure. In addition, a comparison is made to an ADI finite difference procedure. In this comparison, the problem solved was the heat conduction equivalent of a section of the Little Arkansas aquifer system with 18 wells. The geometry was that of a rectangle on three sides with a fourth irregular side representing a river from which fluid entered the aquifer. The manner in which heat conduction parameters can be interchanged in the mathematical model with parameters describing flow through porous media is set forth. The results indicate that the improved Monte Carlo procedure is more efficient than the conventional Monte Carlo procedure in terms of computer execution time and is competitive with, and in some cases, may even be superior to the ADI finite difference procedure.
W79-04557

OCCURRENCE, QUANTITY, AND QUALITY OF GROUND WATER IN TAYLOR COUNTY, TEXAS.
Texas Dept. of Water Resources, Austin.
H. D. Taylor.
Report 224, October 1978. 144 p, 28 fig, 10 tab, 57 ref.

Descriptors: *Texas, *Groundwater, *Groundwater availability, *Water quality, *Data collections, Aquifers, Census, Water wells, Well data, Groundwater resources, Hydraulic properties, Chemical analysis, Drillers logs, Geology, Irrigation wells, Water level fluctuations, Aquifer characteristics, Dissolved solids, Climatology, Groundwater recharge, Geologic formations, *Taylor County(TX), Chemical quality, Choza formation, San Angelo formation, Antlers formation.

The general scope of this study included the collection, compilation, and analysis of data pertaining to the distribution and quality of groundwater in Taylor County. Emphasis was placed on determining the sources of water suitable for domestic, livestock, public supply, industrial, and irrigational uses. Areas and possible sources of present or potential groundwater contamination were determined. Taylor County covers an area of 913 sq mi in west-central Texas. Significant amounts of fresh to moderately saline groundwater occur in aquifers of the Permian, Cretaceous, and Quaternary Systems. The chemical quality of the groundwater varies widely. In general, the water from all water-bearing units is very hard. About 65% of the alluvium groundwater samples in the Tuscola are contained nitrate concentrations ranging from 47 to 326 mg/l. Sewage disposal in Tuscola is by setic tanks, which may account for some of the nitrate. There is slight evidence from 5 wells inventoried in previous years that, historically, nitrate concentrations have been higher in this area than in others. High concentrations of sodium and chloride in groundwater are fairly common over the county and, along with small scattered vegetative-dill areas, may be evidence of groundwater contamination by oil field brines. (Humphreys-ISWS)
W79-04575

ANALYTICAL STUDY OF THE OGALLALA AQUIFER IN DAWSON AND BORDEN COUNTIES, TEXAS, PROJECTIONS OF SATURATED THICKNESS, VOLUME OF WATER IN STOR-

AGE, PUMPAGE RATES, PUMPING LIFTS, AND WELL YIELDS,
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 7C.
W79-04576

THE WATER WITCH: FACT . . . OR FICTION.
For primary bibliographic entry see Field 7B.
W79-04578

CHEMICAL PRECIPITATION-COAGULATION FOR ORGANIC COLOR REMOVAL FROM GROUNDWATERS,
Mississippi State Univ., Mississippi State.
For primary bibliographic entry see Field 5F.
W79-04614

PUBLIC GROUNDWATER SUPPLIES IN WARREN COUNTY,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 7C.
W79-04720

THE COMPUTATIONAL EFFICIENCY AND TAYLOR EXPANSION DERIVATION OF APPROXIMATING EQUATIONS TO THE GROUNDWATER FLOW EQUATION,
Ahmadu Bello Univ., Zaria (Nigeria). Dept. of Physics.
L. K. Kuiper.
Water Resources Research, Vol. 14, No. 6, p. 1171-1181, December 1978. 8 fig, 2 tab, 12 ref.

Descriptors: *Groundwater movement, *Subsurface flow, *Groundwater, *Model studies, Mathematical models, Transmissivity, Storage, Storage coefficient, Equations, Mathematics, Numerical analysis, Analytical techniques, Hydraulic similitude.

A general procedure was presented for the derivation of the approximating equations to a differential equation. As is the case with many such approximating equations, values of the dependent variable evaluated at a cluster of points in the independent variable space are related in a relatively simple manner. The total set of such relations, each with a corresponding cluster, one for each of a set of chosen points in the independent variable space, forms the approximating equations to the differential equation. In the procedure presented, each of these relations is formulated by the use of Taylor expansion about a point centrally located within each corresponding cluster. The procedure was used to derive new approximating equations to the one-dimensional groundwater flow equation, both homogeneous and nonhomogeneous. These approximating equations were shown to exhibit superior accuracy and speed in comparison with others that are in common use presently. Twelve different varieties of approximately equations to the one-dimensional homogeneous groundwater flow equation, many of which are in common use, were compared for accuracy. Results of these comparisons and others for the non-homogeneous case showed that approximating equations with higher-order error e give superior results. For any given variety of approximating equations, it was shown that maximum accuracy is achieved when the quantity g, the magnitude of the spacial increment Delta x squared divided by the magnitude of the time increment Delta t, is properly chosen. What this optimal value of g should be was shown to depend upon the error e and character of the approximating equations, the variability and accuracy of the solution being obtained, and the variability of the transmissivity and storage coefficient. (Sims-ISWS)
W79-04737

GROWTH OF GROUNDWATER MOUNDS AFFECTED BY IN-TRANSIT WATER,
Colorado State Univ., Fort Collins. Engineering Research Center.
N. V. Ortiz, D. B. McWhorter, D. K. Sunada, and H. R. Duke.
Water Resources Research, Vol. 14, No. 6, p 1084-1088, December 1978. 8 fig, 13 ref.

Descriptors: *Aquifers, *Groundwater, *Natural recharge, *Model studies, Mathematical models, Equations, Recharge, Groundwater movement, Storage, Storage capacity, Underground storage, Water table, Water levels, Hydrology, *Groundwater mounds, In-transit water.

An analytical solution accounting for the reduction in storage capacity caused by in-transit water was presented. The solution is for the growth of groundwater mounds in an unconfined aquifer in response to uniform deep percolation from a strip of infinite length but finite width. The solution was obtained by integrating the solution for the analogous case of heat flow in a composite solid with respect to time. The aquifer is homogeneous, isotropic, and infinite in areal extent and rests on a horizontal impermeable base. The results from the analytical solution were compared with those obtained from a numerical model which was verified previously with data obtained from a physical porous media model. Dimensionless curves were presented to afford a relatively simple means of analyzing the growth of groundwater mounds. (Sims-ISWS)
W79-04743

DELAYED AQUIFER YIELD AS A PHENOMENON OF DELAYED AIR ENTRY,
Science and Education Administration, Phoenix, AZ., Water Conservation Lab.
For primary bibliographic entry see Field 2G.
W79-04744

ON THE DETECTION OF SHALLOW AQUIFERS USING THERMAL INFRARED IMAGERY,
Connecticut Univ., Storrs. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 7B.
W79-04745

THE CARBON ISOTOPE GEOCHEMISTRY OF A SMALL GROUNDWATER SYSTEM IN NORTHEASTERN ONTARIO,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
For primary bibliographic entry see Field 2K.
W79-04746

A NEW FUNCTION FOR USE IN THE HODOGRAPH METHOD,
Minnesota Univ., Minneapolis. Dept. of Civil and Mineral Engineering.
O. D. L. Strack, and M. I. Asgian.
Water Resources Research, Vol. 14, No. 6, p 1045-1058, December 1978. 11 fig, 19 ref, 1 append.

Descriptors: *Groundwater movement, *Groundwater, *Rivers, *Model studies, Mathematical models, Flow, Porous media, Phreatic lines, Water table, Water levels, Seepage, Banks, Hydrology, Riverbanks.

A new function, the reference function, was introduced for combined use with the hodograph. The function is applicable to two-dimensional problems of steady groundwater flow through homogeneously permeable porous media. The reference function is applicable to all problems of the above class with the restriction that the boundary in the hodograph plane be composed of segments of straight lines and circular arcs. The function was determined by application of elementary conformal transformations. Use of the reference function was illustrated for the case of unconfined flow toward a riverbank. A graph was presented that gives the length of the seepage face as a function of the flow parameters. The approach for solving the general problem of the above class by use of the reference function was outlined. (Sims-ISWS)
W79-04748

NUMERICAL MODEL FOR SATURATED-UNSATURATED FLOW IN DEFORMABLE POROUS MEDIA. 3. APPLICATIONS,
California Univ., Berkeley. Lawrence Berkeley Lab.
For primary bibliographic entry see Field 2G.
W79-04749

CARBONATE CHEMISTRY OF GROUNDWATER FROM TROPICAL TOWER KARST IN SOUTH THAILAND,
Hong Kong Univ. Dept. of Geography and Geology.
J. I. Pitman.
Water Resources Research, Vol. 14, No. 5, p 961-967, October 1978. 2 fig, 4 tab, 39 ref.

Descriptors: *Water chemistry, *Groundwater, *Karst, Sampling, Data processing, Limestones, Carbonate rocks, Carbon dioxide, Leaching, Ions, Cations, Anions, Chemistry, Geology, *Thailand, Tropical tower karst, Groundwater chemistry.

Waters from tropical tower karst in an area with no seasonal variations in temperature show marked variations in their dissolved carbonate chemistry. Saturation indices for calcite and dolomite indicate that most samples are saturated to supersaturated with these solids. Recent work has suggested that marked latitudinal gradients exist in the carbonate chemistry of groundwaters in limestones, the principal control being the partial pressure of soil carbon dioxide (PCO2). Calculated log PCO2 values for the waters give a mean of -2.12 + or - 0.41. Measured PCO2 values for the soil atmosphere and soil leachates give a mean log PCO2 of -1.43 + or - 0.07. The wide variation of springwater PCO2 is best explained by a predominantly closed system evolution from the initial PCO2 of the soil. (Sims-ISWS)
W79-04752

STOCHASTIC ANALYSIS OF SPATIAL VARIABILITY IN SUBSURFACE FLOWS 2. EVALUATION AND APPLICATION,
New Mexico Inst. of Mining and Technology, Socorro.
A. L. Gutjahr, L. W. Gelhar, A. A. Bakr, and J. R. MacMillan.
Water Resources Research, Vol. 14, No. 5, p 953-959, October 1978. 5 fig, 9 ref.

Descriptors: *Subsurface flow, *Groundwater movement, *Model studies, Mathematical models, Stochastic processes, Variability, Spatial distribution, Hydraulic conductivity, Aquifers, Aquitards, Observation wells, Numerical analysis, Analytical techniques, Groundwater.

The stochastic differential equation describing one-dimensional flow in a statistically homogeneous porous medium was solved exactly, and the results were compared with an approximate solution considering small perturbations in the logarithm of the hydraulic conductivity. The results showed that the logarithmic approximation is valid when the standard deviation of the natural logarithm of the hydraulic conductivity. The results showed that the logarithmic approximation is valid when the standard deviation of the natural logarithm of the hydraulic conductivity sigma sub f is less than 1; the errors increase rapidly for sigma sub f greater than 1. The effective hydraulic conductivity of statistically homogeneous media with one-, two-, and three-dimensional perturbations was determined to the first order in (sigma sub f) sq. The effective conductivity was found to be the harmonic mean for one-dimensional flow, the geometric mean for two-dimensional flow, and (1 + (sigma sub f) sq/6)times the geometric mean for three-dimensional flow. The application of stochastic analysis was illustrated through two elementary network design problems that demonstrate the importance of the correlation length of the hydraulic conductivity and the role of measurement error. (See also W78-09199) (Sims-ISWS)
W79-04753

PREDICTIVE ANALYSES OF GROUNDWATER DISCHARGES IN THE WILLOW CREEK WATERSHED, NORTHEAST NEBRASKA,

Geological Survey, Lincoln, NE. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-04805

WATER-LEVEL DECLINES IN THE MADISON AREA, DANE COUNTY, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-04809

GALERKIN FINITE ELEMENT PROCEDURE FOR ANALYZING FLOW THROUGH RANDOM MEDIA,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Civil Engineering.
B. Sagar.
Water Resources Research, Vol. 14, No. 6, p 1035-1044, December 1978. 5 fig, 2 tab, 18 ref.

Descriptors: *Finite element analysis, *Statistical models, *Groundwater movement, *Heterogeneity, *Hydraulic properties, Flow, Stochastic processes, Porous media, Aquifer characteristics, Probability, Pores, Hydraulic conductivity, Mathematical models, Equations, *Galerkin procedure, Deterministic quantities, Probability mass function.

A method was presented for analyzing flow through a porous medium whose parameters are random functions. Such a medium was conceptualized as an ensemble of media with an associated probability mass function. The flow problem in each member of this ensemble is deterministic in the usual sense. All the solutions belong to a particular Hilbert space, and hence they can be written in terms of linear combinations of its basis functions. This is similar to the Galerkin formulation except that the coefficients in the linear combination are no longer deterministic quantities but random functions. The finite element method in conjunction with a Taylor series expansion was used to get the first two moments of the solution approximately. The method does not require specification of full probability mass functions of the parameters but only their first two moments, and spatial correlations can be accounted for easily. However, it was assumed that the probability mass functions are peaked at the expected value and are smooth in its vicinity. A sample problem was solved to illustrate the procedure. It was observed that the result is sensitive to the element size in the numerical scheme and the variances and spatial correlations of parameters. The expected value of the hydraulic head was found to differ significantly from the results that would have been obtained if the problem had been solved deterministically. (Visocky-ISWS)
W79-04859

ON THE USE OF A MAIN TREND FOR THE KRIGING TECHNIQUE IN HYDROLOGY,
IBM Scientific Center, Venice (Italy).
G. Volpi, and G. Gambolati.
Advances in Water Resources, Vol. 1, No. 6, p 345-349, December 1978. 3 fig, 2 tab, 10 ref.

Descriptors: *Hydrology, *Aquifers, *Model studies, *Mathematical models, Equations, Mathematics, Stochastic processes, Groundwater, Water wells, Water levels, Analytical techniques.

A technique of interpolation based on a stochastic approach and referred to as 'kriging' technique has been contributed recently by the French School. A primary feature of the algorithm is its ability to provide an assessment of the predictive reliability. The accuracy of estimate depends on the evaluation of two stochastic quantities: the variogram, gamma, and the main trend, m, of the hydrologic event, z, to be reconstructed. For an effective use of the method, a correct understanding of the actual role played by m is required. With some ad hoc examples, it was shown that using a polynomial trend with unspecified coefficients as suggested by the general theory may lead to paradoxical results whose behavior is hard to predict a priori. It turned out that increasing the degree of m may yield an increase of the estimation error where one would expect to obtain the opposite. An alternative formulation was suggested which assumes m to be fully known in advance. Its expression was supposed to be derived from both the general behavior of z as is recognizable from the available records and some extra-amount of information related to the general physical knowledge of the hydrological context. If this extra-amount of information related to the general physical knowledge of the hydrological context. If this extra-amount of information is missing, the use of a constant trend should be recommended. (Sims-ISWS)
W79-04870

ILLINOIS COASTAL ZONE MANAGEMENT PROGRAM, 2ND YEAR WORK PRODUCT. VOLUME II. COASTAL GEOLOGICAL STUDIES, HYDROGEOLOGIC, GEOLOGIC, AND ENGINEERING ASPECTS OF LAKE MICHIGAN SURFICIAL DEPOSITS,
Illinois State Dept. of Transportation, Chicago. Div. of Water Resources.
P. B. DuMontelle, K. L. Stoffel, and J. J. Brossman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 153, Price codes: A06 in paper copy, A01 in microfiche. 1976. 105 p, 17 fig, 2 tab, 19 ref, 2 append.

Descriptors: *Shore protection, *Erosion, *Erosion control, *Seepage, *Hydrogeology, *Lake Michigan(IL), *Illinois, *Coastal Zone management, Soil stability, Slope protection, Slope stability, Infiltration, Groundwater, Groundwater movement, Geology, Drainage, Foundation strengths, Bluffs.

This report describes the basic characteristics that determine erosion susceptibility, foundation stability, weathering qualities, slump resistance, and drainage performance of the Illinois-Lake Michigan shore bluffs. Geologic data on sediment characteristics and clay mineralogy are presented with appropriate figures. Foundation strengths, uncombined compressive liquid strengths, moisture content, liquid limits, plasticity indices, shear strengths and wet/dry densities were also measured. The geologic data were gathered from bluff exposures of the area and 14 research boreholes in addition to previously collected information. Groundwater data were gathered from weather records, piezometer installations at Lake Bluff, and bluff-line seep studies along the entire shore. Significant groundwater seepage on the bluff face was mapped in 7 areas which are described extensively. Appendix A includes tables presenting the geologic and engineering data from the boreholes and geologic outcrop sections. The tables give descriptions of each sample including depth, a graphic log, index properties, grain-size fractions and X-ray data. Appendix B includes engineering measurements made of samples available from cross-section boreholes. (Coan-NC)
W79-04874

2G. Water In Soils

HYDROLOGIC BEHAVIOR OF A FORESTED MOUNTAIN SOIL IN COASTAL BRITISH COLUMBIA,
British Columbia Univ., Vancouver. Dept. of Soil Science.
J. de Vries, and T. L. Chow.
Water Resources Research, Vol. 14, No. 5, p 935-942, October 1978. 4 fig, 1 tab, 17 ref.

Descriptors: *Forest soils, *Canada, *Hydrologic properties, *Soil water movement, On-site investigations, Simulated rainfall, Model studies, Mathematical models, Mountains, Forests, Soil water, Infiltration, Wetting, Drainage, Hydraulic conductivity, Soils, Soil horizons, Soil science, *British Columbia.

Inferences with respect to the hydrologic behavior of a West Coast forested mountain soil were based on measurement of the water potential field during the wetting and drainage phases of simulated rainfall events. The field was measured as a continuous function of time with an array of 13 tensiometers in combination with pressure transducers and a data collection system. Measurements were carried out with the forest floor intact, partly disturbed, and totally removed. Inferences were made by interpreting the water potential fields as 'fingerprints of hydrologic behavior.' It was concluded that during a simulated rainfall event, water flow through the profile was partitioned between root channels and the soil matrix which is transversed by the channels. The proportion of the flow conducted by the channels was at its maximum during the non-steady state phase of the event, decreasing to a minimum as steady-state was approached. During the drainage phase of the event, the channels did not contribute to downward flow. The process of internal infiltration was discussed. It causes the soil matrix to wet up both from the surface of the H horizon of the forest floor and from the wetted periphery of the root channels. Results indicated that simulated disturbance of the forest floor down to the mineral soil caused a shift in the water flow pathway from the channels to the soil matrix. It was speculated that this shift was due to closure of the channel openings. It was speculated that the flashy response of streams to rainfall events is related to rapid subsurface storm flow through root channels. Also, because water flow through the soil matrix is much slower than that through root channels, it is likely that forest floor disturbance on a watershed-wide scale would result in an increase in the time lag between the rainfall event and the corresponding streamflow event. (Sims-ISWS)
W79-04564

THE ROLE OF PLANT RESIDUES IN THE FATE OF CADMIUM IN ECOSYSTEMS. A BUFFER AGAINST CONTAMINATION OF WATER SOURCES,
Delaware Univ., Newark. School of Life and Health Sciences.
For primary bibliographic entry see Field 5B.
W79-04584

TIME-DEPENDENT SOLUTIONS TO THE ONE-DIMENSIONAL LINEARIZED MOISTURE FLOW EQUATION WITH WATER EXTRACTION,
Arizona Univ., Tucson. Dept. of Mathematics.
D. O. Lomen, and A. W. Warrick.
Journal of Hydrology, Vol. 39, No. 1/2, p 59-67, October 1978. 3 fig, 12 ref, 1 append. OWRT B-045-ARIZ(10), B-064-ARIZ(2).

Descriptors: *Soil water, Analysis, *Unsteady flow, *Unsaturated flow, Soil water, Infiltration, Drainage, Equations, Conductivity, Saturation, Porous media, Transpiration.

An exact, analytical solution was developed for one-dimensional soil water flow. Assumptions are that the unsaturated conductivity is exponential with pressure head and that the soil moisture diffusivity constant. The surface boundary condition was taken as a time-dependent specified-intake velocity. A sink function for a plant water uptake was described by a sequence of depth-dependent functions which change at specified times. Numerical examples included drainage, infiltration, steady uptake and cyclic surface flux, and uptake patterns. The linearizing assumptions are the most realistic for short cycles, but in any case, the exact nature of the answers make them ideal for checking numerical approximations, such as finite differencing. (Adams-ISWS)
W79-04602

USE OF METHANOL-WATER SOLUTIONS FOR FREEZE PROTECTION OF TENSIOMETERS,
Texas A and M Univ., Lubbock. Agricultural Research and Extension Center.
For primary bibliographic entry see Field 3F.
W79-04605

BASIC MATHEMATICAL MODELS OF TOXICANT TRANSPORT THROUGH THE SOIL PROFILE,
Moskovskaya Selskokhozyaistvennaya Akademiya (USSR).
For primary bibliographic entry see Field 5B.
W79-04649

THE EFFECT OF SALT PRECIPITATION AND HIGH SODIUM CONCENTRATIONS ON SOIL HYDRAULIC CONDUCTIVITY AND WATER RETENTION,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
H. Frenkel, A. Hadas, and W. A. Jury.
Water Resources Research, Vol. 14, No. 2, p 217-222, April, 1978. 5 fig, 4 tab, 21 ref.

Descriptors: *Saline water, Salinity, Irrigation, Leaching, Crop response, Chemical precipitation, Hydraulic conductivity, *Soil-water-plant relationships.

Controlled irrigation management of moderate to poor quality water must assure sufficient movement of solution through the root zone to maintain a salinity regime which a crop can tolerate while at the same time minimizing the deterioration of groundwater or river quality. The work reported here analyzes the major plant-soil-salinity interactions resulting from irrigation with saline water at controlled leaching fractions. Simulations are run for leaching fractions of 0.30, 0.05, and 0.01 and three different water uptake patterns for two high-sulfate waters with different salinity levels: 2.1 and 6.6 mmho/cm. Results suggest that soil hydraulic conductivity and water retention should not be adversely affected by high sodium levels or cumulative salt precipitation even at very low leaching fractions. However, it is probable that plant activity will be impaired by the lower leaching fractions because of high osmotic pressure within the root zone and that root proliferation could be reduced by soil structure cementation resulting from salt precipitation. (Skogerboe-Colorado State).
W79-04650

CALCIUM-SUPPLYING CHARACTERISTICS OF TWO GYPSUM MATERIALS ON SOUTHEASTERN COASTAL PLAIN SOILS,
Texas A and M Univ., Overton. Agricultural Research and Extension Center.
T. C. Keisling, and M. E. Walker.
Soil Science Society of America Journal, Vol. 42, No. 3, p 513-517, May-June, 1978. 2 fig, 2 tab, 16 ref.

Descriptors: *Gypsum, *Calcium sulfate, Peanuts, Granules, *Soil leaching, Particle size, Coastal plains.

Field studies were conducted on two soils to study the manner in which finely and coarsely divided gypsum materials supplied Ca to the soil depth where peanut (Arachis hypogaea L.) fruit absorb Ca. The finely divided material was characterized chemically as $CaSO_4.2H_2O$, approximately 72% $CaSO_4$ or 20.2% Ca and physically as having 88% of the particles < 0.25 mm in diameter. The coarsely divided material was characterized chemically as $CaSO_4$, approximately 92% $CaSO_4$ or 26.5% Ca and physically as having 82% with particle diameters < 4.2 mm, but > 0.5 mm. The amount of Ca transported to a given soil depth was found to be related to the magnitude, order, and frequency of rainfall events. The fine gypsum material was found to be more effective in supplying Ca to the soil depth where peanut fruit are absorbing it early in the growing season than the coarser material. Dissolution of gypsum sources consisting of different particle sizes and subsequent transport of Ca into the fruiting zone of peanuts was not always closely related to the total amount of rainfall. Either the finely or coarsely divided gypsum could supply more Ca to the fruiting zone depending on the rainfall pattern. (Skogerboe-Colorado State)
W79-04662

CHANGES IN BIOCHEMICAL CHARACTERISTICS OF CHERNOZEM SOILS IN THE REGION OF THE WESTERN SLOPE OF THE URAL MOUNTAINS DURING IRRIGATION,
Akademiya Nauk SSSR, Ufa. Inst. of Biology.
I. K. Khabirov, Kh. Khaziev, and F. Sh. Garifullin.
Biol Nauki (Mosc) Vol. 19, No. 10, p 115-122. 1976.

Descriptors: *Irrigation effects, *Chernozems, Soil chemical properties, Sugar beets, Soil biology.

The effects of irrigation on the biochemical activity of the cherozem soils of the western slope areas of the Ural Mountains of the Bashkir ASSR (USSR) were studied. Correlations between enzyme activities, nutrient content, rates of O_2 consumption and CO_2 production, moisture and sugar beet yield were made. Activity rates of phosphatases, saccharases, ureases, dehydrogenases, soil proteases, O_2 consumption and CO_2 production all increased as a result of irrigation. Effectiveness of irrigation increased with use of fertilizers (N, P and K) and deep soil tilling. Copyright 1978, Biological Abstracts, Inc.
W79-04706

TOWARD MORE DETAILED FIELD MONITORING OF VARIABLE SOURCE AREAS,
Bristol Univ. (England). Dept. of Geography.
M. G. Anderson, and T. P. Burt.
Water Resources Research, Vol. 14, No. 6, p 1123-1131, December 1978. 10 fig, 1 tab, 36 ref.

Descriptors: *Soil water movement, *On-site investigations, *Subsurface drainage, Soil water, Rainfall, Precipitation(Atmospheric), Runoff, Streamflow, Hydrographs, Tensiometers, Networks, Instrumentation, Soil water, Potential flow, Subsurface flow, Monitoring, Water sources, Hillslopes, Hollows, Soil water potential.

Variable source area storm flow generation is now a well-accepted process in natural catchments. Although the concept of variable source areas, together with more theoretical modeling, has received much recent attention, detailed field delineation, both seasonally and for short storms, has not. The work reported here used an automatic tensiometer system to obtain continuous data on soil water potential status in a hill-slope hollow. The results discussed demonstrate that source areas can be accurately delineated by such equipment and that hollows are significant source areas at all stages of drainage. Moreover, the convergence shown by the soil water flow nets in such source areas remains almost constant throughout the year. (Sims-ISWS)
W79-04739

IS THE SOIL FROZEN OR NOT. AN ALGORITHM USING WEATHER RECORDS,
Science and Education Administration, Kimberly, ID. Snake River Conservation Research Center.
J. W. Cary, G. S. Campbell, and R. I. Papendick.
Water Resources Research, Vol. 14, No. 6, p 1117-1122, December 1978. 5 fig, 2 tab, 13 ref.

Descriptors: *Frozen soils, *Weather data, *Algorithms, Mathematical models, Soils, Vegetation effects, Vegetation, Temperature, Air temperature, Solar radiation, Precipitation(Atmospheric), Rainfall, Snowfall, Heat flow, Thawing, Freezing, Soil science, Meteorology.

Frozen soil water is important in hydrologic events because it reduces water infiltration. The presence of soil ice can be predicted reasonably well from detailed knowledge of the soil and microclimatic variables, but this type of information is generally unavailable. Consequently, the purpose of this study was to start with fundamental relations and to see how well frozen soil conditions could be identified from daily weather station records of maximum-minimum temperature, solar radiation, and snowfall. Two relations were developed, one based on the soil-atmosphere energy budget and the other on the heat flux across the soil surface layer. Conceptually, the two equations may be used together to give daily snowmelt as well as soil thawing and freezing rates, but in practice, the snowmelt prediction is probably not yet accurate enough for most practical applications. The simpler equation, describing the heat flux in the soil surface, did not require solar radiation input, yet it gave fair predictions of frozen soil on five diverse sites studied in the Palouse region of eastern Washington. Both approaches required only a single constant that accounts for individual site conditions such as slope, aspect, cover, and soil properties. (Sims-ISWS)
W79-04740

DELAYED AQUIFER YIELD AS A PHENOMENON OF DELAYED AIR ENTRY,
Science and Education Administration, Phoenix, AZ., Water Conservation Lab.
H. Bouwer, and R. C. Rice.
Water Resources Research Research, Vol. 14, No. 6, p 1068-1074, December 1978. 8 fig, 10 ref.

Descriptors: *Aquifers, *Pore water, *Water yield, *Soil water movement, Air, Vadose water, Laboratory tests, Mathematical models, Air-earth interfaces, Soil water, Drawdown, Wells, Pumping, Groundwater, Air entry, Delayed aquifer yield.

Delayed release of pore water from a pumped, unconfined aquifer was treated as a situation of restricted air movement in the vadose zone due to layers of high water content. This restricted movement produces below-atmospheric pressures in the pore air above the water table, which cause the water table initially to drop faster than the dewatered zone. The initial yield was less than the full specific yield, which developed after a certain water table drop. Equations were derived that relate delayed yield to air entry value and height above water table of saturated layers in the vadose zone. These equations agreed with results from a delayed yield experiment on a vertical soil column and produced ratios between initial and final yield that resembled those calculated by others from actual pumping tests. An axisymmetric flow system, simulated by interconnected jars with narrow standpipes, produced delayed yield drawdown curves that were amenable to Boulton's analysis. (Sims-ISWS)
W79-04744

NUMERICAL MODEL FOR SATURATED-UNSATURATED FLOW IN DEFORMABLE POROUS MEDIA. 3. APPLICATIONS,
California Univ., Berkeley. Lawrence Berkeley Lab.
T. N. Narasimhan, and P. A. Witherspoon.
Water Resources Research, Vol. 14, No. 6, p 1017-1034, December 1978. 46 fig, 1 tab, 26 ref.

Descriptors: *Porous media, *Saturated flow, *Unsaturated flow, *Model studies, Mathematical models, Numerical analysis, Groundwater, Groundwater movement, Soil water, Soil water movement, Subsidence, Land subsidence, Earthquakes, Construction, Soils, Soil properties, Infiltration, Drainage, Subsurface drainage, Pore pressure, Soil science.

This was the third and conclusive part of a three-part series. The paper described the application of a numerical model for saturated-unsaturated flow in deformable porous media. In all, 10 illustrative examples were presented which not only demonstrated the validity of the method, but also highlighted the fundamental unity that exists in the physic principles of the fields of hydrogeology, soil mechanics, and soil physics. The chosen examples involved such diverse phenomena as soil consolidation, infiltration, and drainage and generation of fluid pressures due to such cyclic loading as earthquakes. (See also W77-11223 and W78-09195) (Sims-ISWS)
W79-04749

RATE OF CAPILLARY WATER ASCENT AS DEPENDENT ON PHYSICAL SOIL PROPERTIES, (IN CZECH),
J. Mistina, and A. T. Kosik.

Ved Pr Vysk Ustavu Rastlinnej Vyroby Piestanoch (13), p 309-316, 1976. (English summary).

Descriptors: *Capillary action, Chernozems, Porosity, *Soil physical properties, Soil water movement, Specific gravity.

Capillary water movement in a chernozem soil correlated positively with soil aggregate diameter and specific gravity; negatively with total porosity and air capacity.
W79-04751

RAPID DETERMINATION OF SOIL WATER CHARACTERISTIC BY THERMOCOUPLE PSYCHROMETRY,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering
F. R. Riggle, and D. C. Slack.
Paper No. 78-2026, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah. 24 p, 6 fig, 1 tab, 34 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Soil water, Moisture content, Moisture tension, Soil moisture, Moisture availability, Soil tests, Osmotic pressure.

A procedure was developed for determination of the soil water characteristic curve with thermocouple psychrometry. Complete soil water characteristic curves were obtained for a Nicollet clay loam, a Waukegan silt loam, and a Hubbard sandy loam within one week in ambient air conditions. The curves obtained by the psychrometer method compared favorably with those obtained by pressure methods. (Skogerboe-Colorado State)
W79-04987

NUTRIENT EFFECTIVENESS IN RELATION TO RATES APPLIED FOR POT EXPERIMENTS: I. NITROGEN AND POTASSIUM,
National Fertilizer Development Center, Muscle Shoals, AL.
G. L. Terman, and J. J. Mortvedt.
Soil Science Society of America Journal, Vol. 42, No. 2, p 297-302, March-April, 1978. 7 fig, 7 ref.

Descriptors: Fertilizers, Nutrients, *Nitrogen, *Potassium, Phosphorus, Rates of application, Greenhouses, Corn(Field), Rice, Crop response.

A N source experiment was conducted on infertile Mountview sil (Typic Paleudult) to evaluate for N sources at multiple rates of applied N and P. Granular ammonium nitrate (AN), sulfur-coated urea (SCU), oxamide (Ox), and isobutylidene diurea (IBDU) were evaluated for corn (Zea mays L.) at N rates of 0, 400, 800, and 1,200 mg/pot (5 kg of soil), each at P rates of 0, 60, 120, 480, and 960 mg/pot. Yield response to applied N was in the order AN >> SCU > Ox > IBDU at the higher rates of applied P. At 60 and 120 mg of applied P/pot, however, P was too deficient for satisfactory evaluation of the N sources. In an experiment with flooded rice (Oryza sativa L.), P limited yields less than did N. In other N-P and P-K factorial experiments, rates of other nutrients and length of growth period also greatly affected crop response to applied N and K. (See also W79-04993)(Skogerboe-Colorado State)
W79-04992

NUTRIENT EFFECTIVENESS IN RELATION TO RATES APPLIED FOR POT EXPERIMENTS: II. PHOSPHORUS SOURCES,
National Fertilizer Development Center, Muscle Shoals, AL.
J. J. Mortvedt, and G. L. Terman.
Soil Science Society of America Journal, Vol. 42, No. 2, p 302-306, March-April, 1978. 4 fig, 3 tab, 12 ref.

Descriptors: Nutrients, Rates of application, Phosphorus compounds, Fertilizers, Greenhouses, Corn(Field), Crop response, Crop production.

Three greenhouse pot experiments were conducted with corn (Zea mays L.) grown on infertile soils to evaluate four fertilizers as sources of P. The granular sources were concentrated superphosphate (CSP, 90% of P water-soluble), monoammonium phosphate (MAP, 100% of P water-soluble), a mixture of 30% of the P as CSP and 70% as dicalcium phosphate (DCP, water-insoluble), and a 10-90% mixture of CSP and DCP. Various rates of P per plot from each source were compared. These P sources and rates were compared at various levels of N and K. The order of effectiveness was the same at all levels of applied N and K: MAP > CSP > 30% CSP + 70% DCP > 10% CSP + 90% DCP. This indicates that on these soils, P was the chief limiting nutrient at all levels of N and K. However, yield levels and the precision of determining differences in effectiveness among sources relative to experimental error increased greatly at higher rates of applied N and K. (See also W79-04992)(Skogerboe-Colorado State)
W79-04993

2H. Lakes

LIMNOLOGICAL ASPECTS OF LAKE MEAD, NEVADA-ARIZONA,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
J. R. Baker, J. E. Deacon, T. A. Burke, S. S. Egdorf, and L. J. Paulson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 507, Price codes: A05 in paper copy, A01 in microfiche. Report No. REC-ERC-77-9, June 1977. 90 p, 18 fig, 32 tab, 129 ref, 3 append.

Descriptors: *Limnology, *Water quality, *Lake Mead(Nevada-Arizona), Las Vegas(Nevada), Phytoplankton, Zooplankton, Bacteria, Aquatic environment, Eutrophication, Water pollution sources, Water pollution effects, Water temperature, Dissolved oxygen, Alkalinity, Water chemistry, Environmental effects, Industrial wastes, Sewage effluents.

Lake Mead, classified as a deep, subtropical, moderately productive desert impoundment with a negative heterograde oxygen profile during the summer, was studied to determine its water quality aspects with regard to the effluents discharged to it by Las Vegas. The study was initiated in 1971. Biweekly and monthly measurements were made of water temperature, dissolved oxygen, conductivity, pH, alkalinity, nutrient concentrations, phytoplankton numbers, chlorophyll a, primary productivity, zoopla ton, concentrations, and coliform bacteria. Phytoplankton and zooplankton success patterns are described. The factors affecting the deposition and distribution of enteric bacteria in Las Vegas Bay are discussed. The distribution of water and enteric bacteria of possible fecal origin into Las Vegas Bay from Las Vegas Wash were determined. The standard methods and techniques for enteric bacteria are examined. The metalimnetic oxygen minimum was caused by biological respiration of the zooplankton and phytoplankton. The high algal biomass and primary production in Las Vegas Bay are caused by the nutrients carried by the dense current on the bottom of the Bay from Las Vegas Wash. The inner portion of Las Vegas Bay is classified as eutrophic, while the outer portion and Boulder Basin are classified as mesotrophic. The most limiting nutrient appears to be nitrogen. (Davison-IPA)
W79-04506

PUBLIC PERCEPTIONS OF ISSUES AND PROBLEMS IN THE LAKE CHAMPLAIN BASIN AREA, A SUMMARY,
Cornell Univ., Ithaca, NY.
H. R. Capener, P. H. Gore, F. F. Schmidt, J. L. Lapi, and T. B. Quinlan.
Lake Champlain Basin Study, New England River Basins Commission, Burlington, Vermont, May, 1978. 56 p, 7 fig, 7 tab, 38 ref.

Descriptors: *Lakes, *Surveys, *Human populations, Census, Investigations, Water users, Water pollution, Wetlands, Land use, Recreation.

The Lake Champlain Basin Study originally identified 13 major work elements for carrying out the regional planning process. Of these work elements, seven major issue areas were selected for inclusion in questionnaires for high school students, key informants, and representatives of organizations. Basin-wide, water pollution concerns were ranked first by both in high school students and representatives of the organizations, and was a close second with the key informants. Land use and recreational issues were ranked second and third. Wetlands issues such as protection of fish and wildlife habitats, game management areas, and bog preservation were fourth. Energy, socio-economic, and planning and management were the last three major issue areas. (Steiner-Mass)
W79-04558

RESERVOIR SYSTEM OPERATING POLICY--CASE STUDY,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
For primary bibliographic entry see Field 6A.
W79-04616

PHOSPHORUS LOADINGS TO LAKES AND SOME OF THEIR RESPONSES. PART 1. A NEW CALCULATION OF PHOSPHORUS LOADING AND ITS APPLICATION TO 13 NEW YORK LAKES,
Cornell Univ., Ithaca, NY. Dept. of Natural Resources.
For primary bibliographic entry see Field 5B.
W79-04621

PHOSPHORUS LOADINGS TO LAKES AND SOME OF THEIR RESPONSES. PART 2. REGRESSION MODELS OF SUMMER PHYTOPLANKTON STANDING CROPS, WINTER TOTAL P, AND TRANSPARENCY OF NEW YORK LAKES WITH KNOWN PHOSPHORUS LOADINGS,
Cornell Univ., Ithaca, NY. Dept. of Natural Resources.
For primary bibliographic entry see Field 5B.
W79-04622

DISSOLVED OXYGEN DEMAND OF REDUCED CHEMICAL SPECIES IN THE WATER COLUMN OF SEBASTICOOK LAKE, MAINE,
Maine Univ. at Orono.
F. P. Liotta.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 680, Price codes: A04 in paper copy, A01 in microfiche. MS Thesis, May 1979. 43 p, 4 fig, 5 tab, 50 ref, 2 append. OWRT A-039-ME(2). 14-34-0001-7042.

Descriptors: *Chemical oxygen demand, Eutrophication, Geochemistry, *Lakes, Water chemistry, Sebasticook Lake, Hypolimnion.

Fifty water column profiles were sampled at Sebasticook Lake, Penobscot County, Maine to determine the impact of reduced chemical species on the dissolved oxygen content of this culturally eutrophic lake. Reduced chemical species measured were CH4g, Fe+2, Mn+2, and total sulfide. Chemical oxygen demand due to eddy diffusion of these chemical species from the anoxic hypolimnion to the epilimnion during summer stratification is capable of causing the anoxic boundary to migrate upward at a rate of 1 m in 7.0 days. Methane is the most abundant reduced chemical species present and is responsible for 88% of the chemical oxygen demand. NH3g generation is believed to be indirectly responsible for the great increase in alkalinity in the anoxic hypolimnion. As NH3g dissolves in the hypolimnion, the resulting OH-aq serve as a H+aq sink, thus allowing an excess of HCO-3aq and CO-3aq to accumulate as CO2g dissolves in the lake water. NH+4aq also helps to satisfy electrical neutrality in the anoxic bottom waters. The solubility products of vivianite, troilite, and rhodochrosite are exceeded in the deepest waters of Sebasticook Lake during summer stratification. Precipitation of rhodochrosite can explain the apparent buffering of Mn+2aq and the break

in the alkalinity profile. Troilite precipitation can explain the decrease in total sulfide concentration in the deepest samples. The concentration of Fe+2aq is 1 to 2 orders of magnitude greater than total sulfide and is thus insignificantly affected by the precipitation of troilite. Acidification of unfiltered lake water samples can result in dissolution of particulate or colloidal Fe, thus yielding high values for dissolved Fe.
W79-04684

THREE-DIMENSIONAL TEMPERATURE MODEL FOR SHALLOW LAKES,
Johns Hopkins Univ., Laurel, MD. Applied Physics Lab.
For primary bibliographic entry see Field 5B.
W79-04731

POSTIMPOUNDMENT SURVEY OF WATER-QUALITY CHARACTERISTICS OF RAYSTOWN LAKE, HUNTINGTON AND BEDFORD COUNTIES, PENNSYLVANIA,
Geological Survey, Pittsburgh, PA. Water Resources Div.
D. F. Williams.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A061 737, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-42, July 1978. 53 p, 8 fig, 12 tab, 16 ref.

Descriptors: *Post-impoundment, *Lakes, *Water quality, *Limnology, *Nutrients, Inflow, Discharge(Water), Water analysis, Thermocline, Stratification, Turnovers, Seasonal, Eutrophication, Physical properties, Chemical properties, Biological properties, Pennsylvania, *Raystown Lake.

Water-quality data, collected from May 1974 to September 1976 at thirteen sites within Raystown Lake and in the inflow and outflow channels, define the water-quality characteristics of the lake water and the effects of impoundment on the quality of the lake outflow. Depth-profile measurements show Raystown Lake to be dimictic. Thermal stratification is well developed during the summer. Generally high concentrations of dissolved oxygen throughout the hypolimnion during thermal stratification, low phytoplankton concentrations, and small diel fluctuations of dissolved oxygen, pH, and specific conductance indicate that the lake is low in nutrients, or oligotrophic. Algal assays of surface samples indicate that orthophosphate was a growth-limiting nutrient. The diatoms (Chrysophyta) were the dominant phytoplankton group found through-out the study period. The lake waters contained very low populations of zooplankton. Fecal coliform and fecal streptococcus densities measured throughout the lake indicated no potentially dangerous areas of water-contact recreation. The most apparent effect that the impoundment had on water quality was the removal of nutrients, particularly orthophosphate, through phytoplankton uptake and sediment deposition. (Woodard-USGS)
W79-04806

IRREGULAR WAVE RUNUP AND OVERTOPPING,
Coastal Engineering Research Center, Fort Belvoir, VA.
J. P. Ahrens, and M. F. Titus.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol. 104, No. WW4, Technical Note, p 439-442, November 1978. 1 fig, 5 ref, 1 append.

Descriptors: *Ocean waves, *Breakwaters, *Wave pile-up, Waves(Water), Coastal structures, Analysis, Equations, Mathematical studies, *Wave height, *Overtopping, Wave runup, Wave spectra, Significant wave, Rayleigh distribution.

Irregular wave overtopping rates for coastal structures are computed with wave runup assumed to have a Rayleigh distribution. Computing irregular wave overtopping rates is easy because they can be treated as a correction to the overtopping rates for the equivalent monochromatic wave conditions. The average irregular wave overtopping rates are lower than the equivalent monochromatic rates for most freeboard conditions. The Rayleigh distribution seems conservative for predicting runup heights, but it is not clear that it also gives conservative overtopping rates. The effects of offshore depths and the reduced run-back when overtopping occurs were not evaluated. (Adams-ISWS)
W79-04814

2I. Water In Plants

DRY MATTER PRODUCTION AND TRANSLOCATION IN MAIZE SUBJECTED TO DROUGHT DURING GRAIN FILL,
Illinois Univ. at Urbana-Champaign. Dept. of Agronomy.
S. K. Jurgens, R. R. Johnson, and J. S. Boyer.
Agronomy Journal, Vol. 70, No. 4, p 678-682, July-August, 1978. 5 fig, 5 tab, 17 ref. OWRT A-070-ILL(2).

Descriptors: *Corn(Field), Moisture stress, Moisture deficit, *Photosynthesis, Translocation, Crop response, Crop production.

The objective of this research was to study the problem of yield loss to be expected and the physiological mechanism that cause the loss due to dry conditions most frequently occurring during the second half of the growing season of maize (Zea mays L.). Drought was imposed during the grain filling stage of maize to determine its relative effects on photosynthesis and translocation. (Skogerboe-Colorado State)
W79-04606

PHOTOSYNTHESIS, TRANSPIRATION, AND LEAF ELONGATION IN CORN SEEDLINGS AT SUBOPTIMAL SOIL TEMPERATURES,
Macquarie Univ., North Ryde (Australia). School of Biological Sciences.
E. W. R. Barlow, L. Boersma, and J. L. Young.
Agronomy Journal, Vol. 69, No. 1, p 95-100, January-February 1977. 7 fig, 33 ref. OWRT-B-028-ORE(6).

Descriptors: Plant physiology, Crop response, Soil temperatures, *Photosynthesis, Corn, *Transpiration, Soil temperature.

The physiology of plant response to low soil temperatures is not well understood. Laboratory studies were conducted to examine the relative sensitivities of rates of leaf elongation, net photosynthesis, and transpiration and the leaf water potential of corn seedlings to decreasing temperature. These parameters were simultaneously monitored, as the soil temperature was decreased from 28 to 10 C at about 4 C increments. The different soil temperatures were imposed during a 10-hour peiod on 14-day-old plants with seven exposed leaves growing at 27.5 C air temperature, a 55% relative humidity, and a light intensity of 753 muE/m2/sec. Any decrease of the soil temperature below 28 C decreased the leaf elongation rate. This was attributed to restricted water uptake which lowered the plant water potential and to the temperature decrease of the shoot apical meristem region. Leaf elongation ceased at the plant water potential of -9 bars due to decline of leaf turgor pressure. (Skogerboe-Colorado State).
W79-04608

THE RELATIONSHIP BETWEEN ABOVEGROUND AND BELOWGROUND BIOMASS OF FRESHWATER TIDAL WETLAND MACROPHYTES,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
D. F. Whigham, and R. L. Simpson.
Aquatic Botany, Vol. 5, (1978), Elsevier Scientific Publishing Company, Amsterdam, The Netherlands, 10 p, 2 figs, 1 tab, 26 refs. OWRT B-060-NJ(1). 14-34-0001-6099.

Descriptors: *Freshwater marsh, Nutrients, Organic matter, *Biomass, *Wetland, Tidal effects, Decomposition.

Aboveground and belowground biomass relationships of 15 annual and perennial freshwater tidal wetland macrophytes were examined. The data showed that regression equations may be used with confidence to estimate belowground biomass from aboveground biomass for most species. The linear regression model was suitable except for one species which had a large belowground component and for which the exponential model was more appropriate. Belowground:aboveground biomass ratios were significantly different for the 8 annual species examined. At peak biomass, all annuals allocated less than one third of the total net annual production into belowground structures. They exhibited distinct seasonal patterns of biomass allocation with more biomass incorporated into belowground components during the early part of the growing season. Perennial species exhibited 4 patterns of biomass allocation with Peltandra virginica (L.) Kunth having a significantly greater mean belowground:aboveground biomass ratio than other perennials. Factors that may control biomass allocation patterns include depth of rooting and life history strategies.
W79-04627

2J. Erosion and Sedimentation

SEDIMENTATION IN A 'HALF-TIDE' HARBOR, PART 1. SEDIMENTATION UNDER ICE-FREE CONDITIONS,
Coastal Engineering Research Center, Fort Belvoir, VA.
C. H. Everts.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A035 667, Price codes: A03 in paper copy, A01 in microfiche. In: Assessment of the Arctic Marine Environment: Selected Topics, Institute of Marine Science, University of Alaska, Fairbanks, 1976. 16 p, 9 fig, 1 tab, 3 ref.

Descriptors: *Arctic, *Harbors, *Sedimentation rates, *Alaska, *Suspended solids, *Dredging, Tidal effects, Estuaries, Tides, Currents(Water), Sediment distribution, Sedimentation, *Small craft harbors, *Arctic estuaries, *Dillingham(AK).

Harbor shoaling becomes a significiant problem when coastal waters are laden with suspended solids and the tidal range is high. Because of currents resulting from the tides and severe ice conditions which exist along much f the Alaskan coast, some smallcraft harbors are constructed as enclosed basins sited adjacent to, rather that within, navigable estuaries. Determination of the shoaling rate and relative importance of factors involved in the shoaling process is essential to the effective design of these harbors. The unique feature of the 'half-tide' harbor is a sill placed in the navigation channel at an elevation greater than that of the basin. Flotation for vessels is provided during low-tide stages, but the sill restricts navigation into and out of the harbor to times of higher tidal elevations. This report described the history and processes of shoaling observed during the ice-free season at an enclosed small-craft harbor at Dillingham, Alaska, since its construction in 1961. (See also W79-04562) (Adams-ISWS)
W79-04562

SEDIMENTATION IN A 'HALF-TIDE' HARBOR, PART 2. SEDIMENTATION DURING PERIODS OF ICE-COVER,
Coastal Engineering Research Center, Fort Belvoir, VA.
C. H. Everts.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A035 667, Price codes: A03 in paper copy, A01 in microfiche. In: Assessment of the Arctic Marine Environment: Selected Topics, Institute of Marine Science, University of Alaska, Fairbanks, 1976. 13 p, 9 fig, 2 ref.

Descriptors: *Arctic, *Harbors, *Sedimentation rates, *Alaska, *Suspended solids, *Dredging, Tidal effects, Estuaries, Tides, Currents(Water), Sediment distribution, Sedimentation, Ice cover, *Small craft harbors, *Arctic estuaries, *Dillingham(AK).

Harbor shoaling is a significant problem when coastal waters are laden with suspended solids and the tidal range is high. Because of tidal currents and severe ice conditions, some small-craft harbors are enclosed basins adjacent to, rather than within, navigable estuaries. The 'half-tide' harbor has a sill in the navigation channel at an elevation greater than that of the basin. Seasonal ice cover often limits the use of small-craft harbors in the northern regions to a few summer months. The role that ice plays in sedimentation may be an important consideration in harbor design. A study was conducted during the ice season in 1973 and 1974 at a harbor near Dillingham, Alaska, to determine the winter shoaling rate and the mechanisms that contribute to winter sedimentation. The purpose of the study, reported herein, was to develop a method to predict quantitatively the difference between winter and summer shoaling rates and to evaluate possible solutions to reduce winter shoaling. (See also W79-04562) (Adams-ISWS)
W79-04563

LONG-TERM PATTERNS OF SEDIMENT PRODUCTION FOLLOWING ROAD CONSTRUCTION AND LOGGING IN THE OREGON COAST RANGE,
Oregon State Univ., Corvallis. Dept. of Forest Engineering.
R. L. Beschta.
Water Resources Research, Vol. 14, No. 6, p 1011-1016, December 1978. 7 fig, 1 tab, 24 ref.

Descriptors: *Sediments, *Suspended solids, *Forest watersheds, *Oregon, Watersheds(Basins), Streams, Streamflow, Erosion, Soil erosion, Forests, Forestry, Road construction, Roads, Clear-cutting, Forest management, Sediment transport, *Oregon Coast Range.

Suspended sediment production after road construction, logging, and slash disposal was significantly increased ($P = 0.95$) on two watersheds in Oregon's Coast Range. A 25% patch-cut watershed showed increases during 3 of 8 posttreatment years. These increases were caused primarily by mass soil erosion from roads. Monthly sediment concentrations before the occurrence of the annual peak flow were increased more than those following the annual peak. Surface erosion from a severe slash burn was the primary cause of increased sediment yields for 5 posttreatment years on a watershed that was 82% clear-cut. Monthly sediment concentrations were generally increased throughout the winter runoff period on this watershed. The flushing of suspended sediment in Oregon Coast Range watersheds is apparent from seasonal changes of suspended sediment rating curves. (Sims-ISWS)
W79-04750

ILLINOIS COASTAL ZONE MANAGEMENT PROGRAM, 2ND YEAR WORK PRODUCT. VOLUME II. COASTAL GEOLOGICAL STUDIES, HYDROGEOLOGIC, GEOLOGIC, AND ENGINEERING ASPECTS OF LAKE MICHIGAN SURFICIAL DEPOSITS,
Illinois State Dept. of Transportation, Chicago. Div. of Water Resources.
For primary bibliographic entry see Field 2F.
W79-04874

DEPOSITION OF NONUNIFORM SEDIMENT ON CONCAVE SLOPES,
Purdue Univ., Lagayette, IN. Dept. of Agricultural Engineering.
S. S. Davis, G. R. Foster, and L. F. Huggins.
Paper No. 78-2519, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Palmer House Hotel, Chicago, Illinois, 19 p. 8 fig, 4 tab, 20 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Sediment transport, Simulation analysis, *Overland flow, Aggregates, Sands, Sediment yield, Homogeneity, Heterogeneity, Slopes, Watersheds(Basins).

A laboratory study was conducted to investigate behavior of simulated natural sediments transported and deposited by overland flow. Aggregate substitutes and sand were studied both as separate homogeneous sediments and as weight proportionally combined heterogeneous sediment mixtures. (Skogerboe-Colorado State)
W79-04917

DESIGN AND OPERATION OF GRADIENT TERRACE SYSTEMS,
Soil Conservation Service, Des Moines, IA.
D. T. Bondurant, and J. M. Laflen.
Paper No. 78-2520, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Palmer House Hotel, Chicago, Illinois, 7 p. 4 fig, 5 tab, 19 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Terracing, *Erosion control, Pollution abatement, Design criteria, Costs, Soil conservation, Water conservation, Sediment control.

Two types of gradient terraces were planned on each of two Iowa fields. Comparison shows that the type of terrace selected will have a major effect on cost of terracing and on farmer acceptance, but little effect on off-field water quality. (Skogerboe-Colorado State)
W79-04918

AN EROSION MODEL FOR ARID WILDLAND WATERSHEDS,
Utah State Univ., Logan. Dept. of Soil Science.
R. J. Wagenet, W. J. Grenney, and J. J. Jurinak.
Paper No 77-2510, Presented at the 1977 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1977, Chicago, Illinois. 22 p, 6 fig, 2 tab, 6 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Computer models, Model studies, *Soil erosion, Sediments, *Heavy metals.

A non-site specific computer model was developed to predict environmental metal distribution resulting from the erosion of stack derived emissions of a coal fired electric generating facility. Model predictions of sediment eroded Zn, Cd, Cr, Pb, and Hg are presented for a 25 year period, and show Hg and Cd to be of environmental concern while indigenous soil levels of Zn, Cr, and Pb greatly outweigh contributions expected from the generating facility. (Skogerboe-Colorado State)
W79-04994

2K. Chemical Processes

SOURCES, LEVELS, AND REACTIONS OF BORON IN FLORIDA WATERS,
Florida Univ., Gainesville. Dept. Environmental Engineering Sciences.
N. E. Carriker, and P. L. Brezonik.
Journal of Environmental Quality, Vol. 7, No. 4, p 516-522, October-December 1978. 5 fig, 3 tab, 16 ref. OWRT A-024-FLA(2).

Descriptors: *Boron, *Photoxicity, *Sewage effluents, Florida, Rainfall chemistry, Water pollution sources, Detergents, Fertilizers, Sampling, Chemical analysis, Precipitation(Atmospheric), Municipal water, Surface waters.

Levels of boron in Florida natural waters are generally low (median value less than 50 micrograms/liter for 120 samples) and not of toxic concern. However, municipal sewage effluents have levels high enough (150-800 micrograms/liter) to cause phytotoxicity, at least to sensitive plants such as citrus. Detergent use of borate softeners and perborate bleaches is evidently the source the elevated boron levels in sewage. Boron concentrations in rainfall increase with proximity to either coast in peninsular Florida, reaching levels of 80-90 micrograms/liter. Marine aerosols, thus, are implicated as an important natural source in the boron cycle of Florida. Model ecosystem studies indicated little bioaccumulation and no toxic hazard at levels expected in natural waters. Interactions of boron with clays and with dissolved organic color (humates) were found to be small, and boron behaves as an essentially conservative element in natural waters. (Sims-ISWS)
W79-04603

CALCIUM-SUPPLYING CHARACTERISTICS OF TWO GYPSUM MATERIALS ON SOUTHEASTERN COASTAL PLAIN SOILS,
Texas A and M Univ., Overton. Agricultural Research and Extension Center.
For primary bibliographic entry see Field 2G.
W79-04662

FACTORS CONTROLLING THE ESTUARINE CHEMISTRY OF ARSENIC,
Skidaway Inst. of Oceanography, Savannah, GA.
For primary bibliographic entry see Field 2L.
W79-04728

THE CARBON ISOTOPE GEOCHEMISTRY OF A SMALL GROUNDWATER SYSTEM IN NORTHEASTERN ONTARIO,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
P. Fritz, E. J. Reardon, J. Barker, R. M. Brown, and J. A. Cherry.
Water Resources Research, Vol. 14, No. 6, p 1059-1067, December 1978. 5 fig, 5 tab, 23 ref. NRC A7954, A9170.

Descriptors: *Carbon radioisotopes, *Geochemistry, *Water table aquifers, *Canada, Carbon, Carbon dioxide, Carbonate rocks, Bacteria, Methane, On-site-data collections, Sampling, Hydrologic data, Groundwater movement, Piezometers, *Canadian shield, Fractionation, Carbon sources.

The carbon isotopic composition (13C and 14C) of the inorganic carbon dissolved in the waters of a small, largely unconfined aquifer in unconsolidated sediments on the Canadian Shield has been investigated. Three principal carbon sources are recognized: soil CO_2, rock carbonate, and biogenic CO_2. The average delta C value of the soil CO_2 is close to -21.0 + or - 1.5%, and present-day 14C activities of the soil CO_2 vary between 130 and 162% modern 14C. Very minor amounts (less than 1.0%) of carbonate minerals (delta 13C = 0.6 parts per thousand) are present within the aquifer and react with this soil CO_2 to produce a dissolved inorganic carbon (DIC) with 14C activities which are as much as 50% below the initial activities of the soil CO_2. The third carbon source, a biogenic CO_2, could be detected only indirectly, and its presence is primarily deduced from the occurrence of methane in the deeper parts of these aquifers. The large isotope fractionation which occurs during bacterial coproduction of CO_2 with this methane results, however, in a 13C-rich CO_2, and thus a DIC with high delta 13C values. Values of delta 13C as high as +11 parts per thousand have been measured in groundwaters on the Canadian Shield. Since the origin of the destroyed organic matter is not yet known, no assessment of the importance of this CO_2 for the 14C contents of the DIC is possible. (Visocky-ISWS)
W79-04746

SAMPLING AND CHEMICAL INTERPRETATION OF PRECIPITATION FOR MASS BALANCE STUDIES,
Colorado Univ., Boulder, Dept. of Environmental Population and Organismic Biology.
For primary bibliographic entry see Field 2B.
W79-04747

CARBONATE CHEMISTRY OF GROUNDWATER FROM TROPICAL TOWER KARST IN SOUTH THAILAND,
Hong Kong Univ. Dept. of Geography and Geology.

For primary bibliographic entry see Field 2F.
W79-04752

TRACE ELEMENTS IN THE SEDIMENTS OF THE BUFFALO RIVER, ARKANSAS,
Arkansas Univ., Fayetteville.
For primary bibliographic entry see Field 5A.
W79-04956

2L. Estuaries

SEDIMENTATION IN A 'HALF-TIDE' HARBOR, PART 1, SEDIMENTATION UNDER ICE-FREE CONDITIONS,
Coastal Engineering Research Center, Fort Belvoir, VA.
For primary bibliographic entry see Field 2J.
W79-04562

SEDIMENTATION IN A 'HALF-TIDE' HARBOR, PART 2. SEDIMENTATION DURING PERIODS OF ICE-COVER,
Coastal Engineering Research Center, Fort Belvoir, VA.
For primary bibliographic entry see Field 2J.
W79-04563

VERIFICATION OF AN ESTUARINE MODEL FOR APALACHICOLA BAY, FLORIDA,
Florida Univ., Gainesville. Dept. of Civil Engineering.
D. S. Graham, J. M. Hill, and B. A. Christensen.
In: Proc. Specialty Conf. on 'Verification of Mathematical and Physical Models in Hydraulic Engineering', ASCE, College Park, MD on August 9-11, 1978. 9 p, 8 fig, 7 ref. SG-04-7-158-44046.

Descriptors: *Estuaries, *Water quality, *Model studies, Hydrodynamics, *Apalachicola Bay(FL), Imagery, Landsat imagery, Florida, Estuarine models, Hydrodynamic models.

A research project at the Hydraulic Laboratory of the University of Florida involves linking appropriate basin run-off and estuarine models to quantitatively predict the transient effects of runoff emanating from upland basin activities, particularly forestry practices, upon the biology and water quality of Apalachicola Bay, FL. A promising method of gathering synoptic verification data is combining field investigations with Landsat imagery, preferably simultaneously. The data so gathered and estimated are instantaneous and therefore amenable for verification of so-called real-time water-quality and hydrodynamic numerical models. (NOAA)
W79-04582

TRANSPORT OF NUTRIENTS AND CARBON FROM THE NANAIMO RIVER TO ITS ESTUARY,
Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station.
R. J. Naiman, and J. R. Sibert.
Limnology and Oceanography, Vol. 23, No. 6, p 1183-1193, November 1978. 7 fig, 2 tab, 33 ref.

Descriptors: *Rivers, *Estuaries, *Nutrients, *Carbon, On-site investigations, Coasts, Tidal waters, Mud flats, Tidal effects, Tides, Nitrogen, Nitrates, Phosphorus, Chlorophyll, Organic compounds, Sampling, Data processing, Analytical techniques, Water quality, Water chemistry, *Nanaimo River(British Columbia), *Vancouver Island.

Over an annual cycle, concentrations of inorganic nitrogen, phosphorus, and organic carbon were measured slightly upstream from the confluence of the Nanaimo River, British Columbia, and its estuary. Inorganic nitrogen and phosphorus concentrations in river water are low most of the year and may not be important in supplying these nutrients to the estuarine mudflat. Large amounts of dissolved organic carbon (DOC) and fine particulate organic carbon (FPOC) are exported from the river to the mudflat (about 2,000 and 56 gC/sq m/yr), but the actual amount retained and utilized by the mudflat community is not known. Comparison with in situ primary production on the mudflat showed that fluvial DOC may be the greatest source of carbon to the system. A conceptual hypothesis was presented which relates basin morphometry and retention structures to estuarine efficiency in retaining nutrient and carbon inputs. (Sims-ISWS)
W79-04726

SHELF FLUSHING RATES BASED ON THE DISTRIBUTION OF SALINITY AND FRESHWATER IN THE GEORGIA BIGHT,
Skidaway Inst. of Oceanography, Savannah, GA.
L. P. Atkinson, J. O. Blanton, and E. B. Haines.
Estuarine and Coastal Marine Science, Vol. 7, No. 5, p 465-472, November 1978. 4 fig, 12 ref, ERDA E(38-1)-889, NSF GA-27725.

Descriptors: *Continental shelf, *Sea water, *Freshwater, *Spatial distribution, *Georgia, *Atlantic Ocean, *Gulf Stream, Coasts, Salinity, Saline water-freshwater interfaces, Runoff, Oceans, Rivers, Water temperature, Oceaography, *Georgia Bight, Flushing rates.

Freshwater off the Georgia, South Carolina, and northeast Florida coast varies from 5 to 12 cu km, depending on the local runoff. The flushing rate calculated from the freshwater volume and river runoff rate is relatively invariant at 2.7 months. This invariance is thought to imply a constant flushing process, and it was postulated that Gulf Stream meanders and eddies are important in that process. A simplified calculation involving Gulf Stream meander frequency and typical entrainment dimensions produced a flushing rate of 2-3 months. (Sims-ISWS)
W79-04727

FACTORS CONTROLLING THE ESTUARINE CHEMISTRY OF ARSENIC,
Skidaway Inst. of Oceanography, Savannah, GA.
D. G. Waslenchuk, and H. L. Windom.
Estuarine and Coastal Marine Science, Vol. 7, No. 5, p 455-464, November 1978. 6 fig, 3 tab, 14 ref.

Descriptors: *Arsenic compounds, *Estuaries, *Georgia, Sampling, Rivers, Surveys, Water quality, Water pollution, Pollutants, Path of pollutants, Mixing, Salinity, Organic compounds, Sediments, Carbon, Water chemistry, Chemical reactions, Biochemistry, Coasts, Tidal waters.

Studies on several southeastern U.S. rivers revealed that arsenic is largely unreactive in the estuarine environment. Dissolved pentavalent arsenic, the only detectable species, behaves conservatively (within experimental accuracy) in the estuary as fresh and saline waters mix. Complexes occur between arsenic and low molecular weight dissolved organic matter. Unlike high molecular weight organics, the low molecular weight organic fraction passes conservatively through the estuary, carrying the complexed arsenic. These complexes presumably prevent adsorption and coprecipitative interactions between arsenate and flocculating iron hydroxides and humics. Arsenic which enters the estuary associated with particulates apparently remains so, and accumulates in the sediments. If post-depositional remobilization does occur, it has only a small, unmeasurable effect (less than 7%) on the dissolved arsenic concentration in the water column. The biota do influence the speciation of arsenic associated with estuarine suspended particulates however. A dimethylarsenic maximum at mid-estuary reflects biomethylation of inorganic arsenic. (Sims-ISWS)
W79-04728

EFFECT OF SALT UPON HOT-WATER DISPERSION IN WELL-MIXED ESTUARIES,
Cambridge Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.
R. Smith.
Estuarine and Coastal Marine Science, Vol. 7, No. 5, p 445-454, November 1978. 4 fig, 17 ref, 1 append.

Descriptors: *Dispersion, *Buoyancy, *Thermal pollution, *Model studies, Mathematical models, Numerical analysis, Water circulation, Mixing, Salinity, Salts, Discharge(Water), Powerplants, Cooling water, Estuaries.

Temperature and salinity variations both give rise to buoyancy-driven currents. Thus, when hot water is discharged into estuaries, the flow is changed both by the heat and by the induced perturbation of the salinity distribution. If cross-sectional mixing takes place in much less than the tidal period, then it can be shown that the salinity anomaly and the temperature distribution satisfy coupled nonlinear diffusion equations. For weak buoyancy effects, the interactions are such as to disperse heat preferentially inland. Quantitative estimates suggested that the asymmetry between inland and out-to-sea dispersion coefficients can be as much as 50%. (Sims-ISWS)
W79-04729

COMPARATIVE STUDY OF THE FIXATION OF INORGANIC MERCURY ON THE PRINCIPAL CLAY MINERALS AND THE SEDIMENTS OF THE LOIRE ESTUARY,
Nancy-1 Univ. (France). Lab. de Toxicologie.
M. Frenet-Robin, and F. Ottmann.
Estuarine and Coastal Marine Science, Vol. 7, No. 5, p 425-436, November 1978. 6 fig, 11 tab, 13 ref.

Descriptors: *Mercury, *Clays, *Laboratory tests, *On-site investigations, Adsorption, Salinity, Turbidity, Tidal waters, Water circulation, Water chemistry, Chemical analysis, Montmorillonite, Illite, Kaolinite, Sediments, Suspended solids, Pollutants, Water pollution, Pollutant identification, Rivers, Estuaries, *France, *Loire Estuary(France).

Samples of kaolinite, illite, and montmorillonites were agitated with solutions of mercuric chloride at different salinities, clay turbidities, and concentrations of mercuric ions. The rates of adsorption and maximum quantities adsorbed were obtained in terms of these factors. Clays with known quantities of adsorbed mercury were agitated with fresh and salt water to measure rates of desorption. The values obtained were compared with an analysis of the water and sediments of the Loire Estuary, based on a large number of samples taken over the period 1972-1975. Mercury pollution has decreased considerably over this period. (Sims-ISWS)
W79-04730

RECREATIONAL BOATING ON THE TIDAL WATERS OF MARYLAND. A MANAGEMENT STUDY.
For primary bibliographic entry see Field 6B.
W79-04876

DESIGN CONCEPTS FOR IN-WATER CONTAINMENT STRUCTURES FOR MARSH HABITAT DEVELOPMENT,
Coastal Engineering Research Center, Fort Belvoir, VA.
For primary bibliographic entry see Field 5E.
W79-04925

MORPHOMETRY OF A TIDAL MOUTH, ACCORDING TO ITS DISCRETE MODEL,
V. A. Zholondz'.
Soviet Hydrology: Selected Papers, Vol. 16, No. 1, p 1-8, 1977. 2 fig, 1 append. Translated from Trudy Gosudarstvennogo Gidrologicheskogo Instituta, No. 232, p 24-37, 1977.

Descriptors: *Estuaries, *Geomorphology, *On-site investigations, *Model studies, Remote sensing, Aerial photography, Mathematical models, Computer models, Hydrometry, Rivers, Tidal waters, Tides, Tidal effects, Channels, Simulation analysis.

The major result of these investigations was proof that a combination of aerial photography (or some remote means of obtaining information), hydrometry, and the most modern methods of numerical

simulation using modern computers makes it possible to reproduce in natural size the dynamic objects of the earth in the form of volumetric or plane numerical coordinate models. The developed numerical model makes it possible to imitate a natural object in four-dimensional space with complete automation of the computation process and proof of the viability of the general method of constructing such models. The model makes it possible to compute such characteristics as area and volume with any preassigned accuracy, ensuring long storage of information over the investigation period and reception of cartometric and hydrometric data on the intermediate state of the object at the instant of time of interest to the researcher. The use of natural numerical simulation to study natural dynamic objects eliminates the need for expensive field investigations. (Sims-ISWS)
W79-04950

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

CONCEPTUAL DESIGN STUDY OF A ONE MILLION GALLON PER DAY MSM DESALINATION PLANT REPLACEMENT FOR DEMONSTRATION PLANT NO. 2 AT POINT LOMA, SAN DIEGO, CALIFORNIA.
The Fluor Corp. Ltd., Los Angeles, CA.
Available from Supt. of Documents, GPO, Washington, DC 20402. OSW Research and Development Progress Report No. 252, April 1967. 147 p, 28 fig, 6 tab. 14-01-0001-414.

Descriptors: *Desalination plants, *Desalination processes, *Facilities, Flash distillation, Equipment, Scaling, Design criteria, Capitol costs, Estimated costs, San Diego(California).

The development of a Title I conceptual design, including cost estimates, for a one million gallon/day sea water conversion plant is presented. The plant will incorporate equipment and facilities provided by the original plant which remain on the site. This equipment includes: the oil-fired package boiler with fuel oil unloading, storage, pumping and heating equipment; sea water intake system; cooling tower; and plant building and roads. The plant will employ the multistage-multieffect flash process developed for the large plant with an initial maximum brine temperature of 250F. The plant description consists of the process description, special design considerations, equipment descriptions, basic plant equipment lists, utilities, heat and material balance, Effect IA equipment list, and flow diagrams and drawings. The three scale control systems, slurry recycle, Lime-MagCarbonate, and fluidized resin are detailed. Capital cost estimates include costs for the basic plant, high temperature Effect IA, slurry recycle, fluidized resin and Lime-MagCarbonate. Applicable codes and standards are listed. (Davison-IPA)
W79-04511

FINAL THREE YEARS' PROGRESS ON STUDY AND FIELD EVALUATION OF SEA WATER STILLS.
Battelle Memorial Inst. Columbus, OH.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-183 870, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 190, May 1966. 90 p, 46 fig, 7 tab, 24 ref. 14-01-0001-284.

Descriptors: *Solar distillation, *Solar stills, *Water conversion, *Desalination processes, Investigations, Desalination apparatus, Economics, Cost analysis, Estimated costs, On-site tests, Laboratory tests.

A study of the single-effect solar still aimed at reducing the cost of solar distilled water through finding ways to lower the costs of constructing, operating, and maintaining the still, and finding ways to increase still productivity is reported. Field testing, analytical studies, and laboratory still work were carried out. Field testing revealed that glass covered basin stills were the most satisfactory, and appear to be practical for application in some areas of the world. An economic study indicated that under some conditions solar could produce fresh water at a lower cost than other types of conversion procedures. Developments in plastic technology show a potential of making the air-inflated plastic covered stills more economical than the glass covered units. It is concluded that: the glass covered basin still is practical and durable; distilled water can be produced for about $3.00/thousand gallons in developing countries; this method is more economical than the vapor compression or flash distillation processes when 50,000 gallons/day or less is required; feed water should be filtered to eliminate the formation of slime growth in the still; the performance of a basin still can be predicted; and the economy of any contemplated installation can be assessed realistically. (Davison-IPA)
W79-04512

RESEARCH ON METHODS FOR SOLAR DISTILLATION,
New York Univ., NY. Engineering Research Div.
M. Telkes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 388, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 13, December 1956. 77 p, 17 fig, 12 tab, 5 ref, 1 append. 14-01-001-68.

Descriptors: *Solar distillation, *Solar stills, *Water conversion, *Desalination processes, *Economic evaluation, Investigations, Desalination apparatus, Water purification, Water treatment, Saline water, Cost comparisons, Heat transfer, Heat exchangers, Equipment.

An investigation into reducing the total cost of sustained conversion of sea, or other saine water to fresh water in large quantities, using solar energy, through developing new methods and improving existing methods is reported. Tilted flat type solar stills and roof-type stiils were compared, and it was determined that the tilted stills yielded 26 to 50% more during the summer. The heat transfer calculations used for the comparison are presented and discussed. The construction of tilted flat stills is described. Experiments were performed using models of the flat tilted still, the 'standard' roof-type still, and a semi-roof type still constructed for the experiments; the results of these experiments are presented. Multiple effect solar stills, previously developed, were used with one and five stages on each side of the heat exchanger in laboratory experiments, and a ten stage multiple effect still was developed for tests made with sea water. The materials used in the multiple effect stills were economically evaluated, and it was concluded that a 10 stage solar still, costing three times as much as a single effect still, could produce six times more water. (Davison-IPA)
W79-04513

SECOND TWO YEARS' PROGRESS ON STUDY AND FIELD EVALUATION OF SOLAR SEA-WATER STILLS.
Battelle Memorial Inst., Columbus. OH.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-185 487, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 147, July 1965. 89 p, 70 fig, 10 tab. 14-01-0001-108.

Descriptors: *Water conversion, *Saline water, *Solar distillation, *Solar stills, Linings, Asphalt, Desalination processes, Wettability, Evaluation, Investigations, On-site investigations.

The evaluation and operation of solar stills which convert saline water to fresh water is reported. A deep-basin still, constructed to replace a still that was badly damaged during a 1960 hurricane, has performance characteristics approximately the same as the one it replaces. Although tilted wick stills are more difficult to operate and have shorter lives, they are more efficient than basin stills. Four vertical-envelope stills were unsatisfactory due to the poor wettability of their wicks and susceptibility to wind damage. The all plastic inflated-tube still performed successfully with productivity levels close to those of the basin stills. Butyl rubber sheeting, asphalt-impregnated-jute, and a prefabricated asphalt mat are being evaluated as basin liner materials. Asphalt paving leaked excessively when it was tried. New distillate trough materials, new glass-sealing methods, and single-strength glass covers are being investigated. Control methods investigated for the slime growth in the basins have been unsuccessful. (Davison-IPA)
W79-04514

DEVELOPMENT OF A THIN-LIQUID-FILM MEMBRANE UNIT FOR DESALINATION BY REVERSE OSMOSIS,
Dorr-Oliver, Inc., Stamford, CT.
D. S. Davies, and J. G. Canamare.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-197 789, Price codes: A06 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 420, June 1969. 100 p, 29 fig, 9 tab, 13 ref, 1 append. 14-01-0001-542.

Descriptors: *Desalination processes, *Desalination apparatus, Laboratory tests, Laminar flow, Membranes, Velocity, Reverse osmosis, Films, Design criteria, Water treatment, Water purification.

A study, conducted in two phases, to establish design criteria for units embodying the laminar flow, narrow channel principle, and to develop a 1000 gpd narrow channel device to demonstrate the validity of the narrow channel concept is reported. During Phase I, a test cell was constructed and successfully operated which permitted the characterization of desalination in a narrow channel under laminar flow conditions. Results showed that a velocity dependence exists, and low laminar flow velocity moduli were higher than predicted. Theoretical predictions were more closely duplicated by higher velocities. During Phase II, the laboratory study was expanded to a pilot scale. Testing was carried out principally on sea water having a salt content range of 25,000 to 30,000 ppm and operating at 1500 psi. Initial results of the program paralleled the laboratory work. Higher polarization values were obtained with low corresponding salt rejections. Higher moduli values at low feed velocity and moduli approaching the theoretical at high velocities was characteristic. Salt rejections gradually increased above that obtained by normal membrane consolidation. This was due to seal leakage from the high pressure feed side to the atmospheric pressure product channel. Resuls of both study phases show that the thin channel concept is valid and can be incorporated into practical large scale desalination devices, but thin channel design was not optimized. (Davison-IPA)
W79-04515

REVERSE OSMOSIS FOR WATER DESALINATION,
General Atomic Co., San Diego, CA.
U. Merton, H. R. Lonsdale, R. L. Riley, and K. D. Vos.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-184 120, Price codes: A10 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 208, September 1966. 219 p, 36 fig, 57 tab, 94 ref. 14-01-0001-250.

Descriptors: *Reverse osmosis, *Membranes, *Permeability, *Membrane process, Thin films, Desalination processes, Water purification, Water treatment.

A study of reverse osmosis covered flow relationships, boundary-layer effects, theories of membrane transport, the properties of cellulose acetate

membranes, the preparation and properties of new membrane materials, and the economics of the reverse osmosis process. Because of their excellent behavior in reverse osmosis, cellulose acetate membranes are emphasized. The permeability of these membranes, the structure and method of formation of modified membranes, the variables affecting the lifetime of modified membranes, membrane compaction, and the preparation of thin films are examined in depth. A search for membrane materials as potential alternates for cellulose acetate was relatively successful. The current status of reverse osmosis research is assessed. (Davison-IPA)
W79-04516

DEVELOPMENT OF IMPROVED ION-SELECTIVE MEMBRANES FOR DESALTING WATER, PART I AND PART II,
Southern Research Inst., Birmingham, AL.
W. C. Sheehan, R. W. Ligett, and E. B. Dismukes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-177 086, Price codes: A06 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 202, August 1966. 109 p, 41 tab, 13 ref, 5 append. 14-01-0001-347 and 14-01-0001-508.

Descriptors: *Desalination processes, *Electrodialysis, *Membranes, *Anions, *Cations, *Membrane processes, Cellulose, Monomolecular films, Radiation, Gamma rays, Ion transport, Water quality, Water quality control parchment.

Research on the preparation and evaluation of experimental membranes for use in electrodialysis is reported. In Part I anion-selective membranes were prepared by grafting two types of basic monomers to cellophane base films with gamma radiation from cobalt-60 and then treating the grafted material with methyl iodide to quarternize the amine groups. The higher rates of salt diffusion permitted by these membranes can be improved by using cellophane film initially cross-linked with tris (1-aziridinyl) phosphine oxide (APO). Cation-selective cellophane having acceptable transference numbers, electrical resistances and difussion values were prepared by cross-linking cellophane film with APO, and grafting sodium styrene sulfonate onto the film with gamma radiation. In Part II parchment was investigated as an alternative substrate material. The data indicate that parchment is a better base film than cellophane, denitrated nitrocellulose, and cellulose diacetate because of its greater tearing strength. Anion-selective membranes with desirable transport properties capable of withstanding electrodialysis were produced by cross-linking parchment with APO, graft polymerizing 4-vinylpridine with gamma radiation, and quarternizing the grafted polymer. Cation-selective membranes with satisfactory initial properties and a tendency to deteriorate in ion selectivity during electrodialysis were prepared by cross-linking parchment with APO and graft polymerizing sodium styrene sulfonate. (Davison-IPA)
W79-04517

EVALUATION OF AN ELECTROCHEMICAL DESALINATION PROCESS FOR BRACKISH WATE,
Oklahoma Univ., Norman.
G. W. Reid, F. M. Townsend, E. H. Klehr, L. E. Streebin, and A. Hu.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 911, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 498, December 1969. 65 p, 11 fig, 29 tab, 5 ref, 3 append. 14-01-0001-1454.

Descriptors: *Desalination, *Desalination processes, *Ion adsorption, *Desalination apparatus, Electrodes, Membranes, Membrane processes, Cation adsorption, Anion adsorption, Electrodialysis, Water purification, Water quality, Water quality control, Brackish water, Engineering, Hydraulics.

An engineering evaluation of the ion-adsorption process for the desalination of brackish water is reported. An ion-adsorption unit was made by modifying a commercial electrodialysis apparatus, the 'Stackpack' whereby the concentrating chambers were eliminated. Saline water was forced to flow through the tortuous path spacers between the anion and cation selective membranes of the diluting chambers, where it was desalinated when anions were absorbed onto the anion membranes and cations onto the cation membranes under direct current. After the membranes became saturated with their absorbed ions, the polarity of the electric current was reversed, and the ions desorbed into the water stream which was rejected to waste. Initial tests, run on a single pair of membranes using sodium chloride, were followed by tests on brackish water from the Washita River and a well in the Lake Thunderbird area. The number of membrane pairs was increased to three, and the testing continued to obtain factors for building a unit of any size. Based on these factors, it was predicted that 20 membrane pairs would yield 17.9 gallons/day of product water when used as an ion-adsorption process. The same unit, when used as an electrodialysis apparatus on the same water would yield over 500 gallons/day. Attempts to increase the performance level of the ion-adsorption process were unsuccessful. It is concluded that the ion-adsorption process is not economically competitive with the electrodialysis process. (Davison-IPA)
W79-04518

FIFTH ANNUAL REPORT, SALINE WATER CONVERSION PLANT NO. 1, FREEPORT, TEXAS.
Stearns-Roger Inc., Denver, CO.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-206 291, Price codes: A14 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 253, March 1967. 292 p, 67 fig, 38 tab, 6 ref, 1 ammend.

Descriptors: *Desalination plants, *Desalination processes, *Long-tube vertical distillation, *Desalation, Water purification, Mechanical equipment, Hydraulic machinery, Economics, Capital costs, Operating costs, Cost analysis, Cost comparisons, Evaluation, On-site investigations, Corrosion, Construction materials, Evaporation, Construction, Demonstration Plant No. 1.

A wide variety of information findings concerning the Long-Tube Vertical (LTV) multiple-effect evaporation method of desalination employed by Demonstration Plant No. 1, Freeport, Texas, is presented. The technical, logistical, and economic evaluations for Fiscal year 1966 operations are discussed in addition to the process and mechanical development program results as related to the LTV process in particular, and desalination in general. Capital and operating costs are compared to theoreti 'normalized' capital and operating costs. Production, economy ratios, costs averages, and maintenance problems are presented. A technical evaluation of the existing process, equipment, corrosion, and construction materials is included. The detailed process evaluation includes presently defined limitations of the temperatures, and construction ratios for scale-free operation of LTV evaporators without presoftening the feed water. Results of tests with newly installed equipment of advanced design are presented. Recommendations and findings of a study which resulted in the decision to extend the evaporation train to 17 effects and other major modifications are included along with conclusions, recommendations and proposals. A process flow diagram is provided. (Davison-IPA)
W79-04519

NEW SYNTHETIC MEMBRANES FOR REVERSE OSMOSIS DESALINATION,
Arthur D. Little Research Inst., Inveresk (Scotland).
A. Sharples, and G. Thompson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-182 535, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 329, October 1967. 66 p, 20 fig, 10 tab, 22 ref. 14-01-0001-741.

Descriptors: *Reverse osmosis, *Membranes, *Membrane processes, *Copolymers, Thin films, Desalination, Desalination processes, Water purification, Water treatment, Brackish water, Cellulose, Plastics.

The search for membranes with improved performance for use in the reverse osmosis process for water desalination is reported. Currently, the most successful membrane is cellulose acetate. The present study, in two parts, is concerned with the copolymer system based on methyl methacrylate coupled with a sugar containing monomer, 6-0-methacryloyl 2-D galactopyranose. Part 1 presents the preparation and characterization of thin homogeneous films. The detailed study of these films includes casting solvents, throughput and rejection characteristics, time-dependence of flow characteristics, and the effect of acids and alkalis. Part 2 presents the problem of casting these problems in a suitable asymetric form to obtain high throughput membranes suitable for use in a commercial process. Although it was demonstrated that these copolymers could be cast in high throughput form while retaining the characteristics of homogeneous membranes, the casting conditions were not optimized, and performance did not equal those of cellulose acetate membranes. These copolymer membranes are able to reject divalent ion salt when sodium chloride rejection is low. One membrane rejected 94% of magnesium sulfate while rejecting only 20% of sodium chloride, indicating potential use in brackish water purification. Alkali stability for copolymer membranes is greater than for cellulose acetate. (Davison-IPA)
W79-04520

DEVELOPMENT OF DIRECT CONTACT CONDENSATION MULTISTAGE FLASH DISTILLATION PROCESS: PHASE II,
Atomics International Div., Canago Park, CA.
A. L. Kohl, T. T. Shimazaki, J. R. Wetch, and W. B. Suratt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 588, Price codes: A08 in paper copy, A01 in microfiche. OSN Research and Development Progress Report No. 566, May 1970. 141 p, 39 fig, 23 tab, 19 ref, 4 append. 14-01-0001-2266.

Descriptors: *Flash distillation, *Condensation, Desalination, Heat exchangers, Plastics, Tedlar, Heat transfer, Costs.

A program continuing an investigation of techniques which increase the heat transfer coefficient and the condensation rate in the direct contact condensation unit is discussed. Four specific tasks were involved in the program. The 35 test runs made during the Direct Contact Condensation (DCC) Test provided data on the effects of water depth and flow rate, steam pressure and velocity, the presence of turbulance promotors in the water, and other variables. Plastic film heat exchanger testing demonstrated the practicability of fabricating tubes on a continuous basis using the process conceived during Phase I. Testing of the reference plastic film material (Tedlar) was continued, and simple screening and evaluation tests were conducted on other plastics which were potentially lower in cost. Only carbon loaded crosslinked polyethylene exhibited promise for temperatures in the 200F range. Less expensive than Tedlar, it showed good strength characteristics. Capital costs of large plants using the Atomic International (AI) DCC multistage flash distillation on (MSF) are potentially less than MSF or combined vertical tube evaporator (VTE) plants. However, the cost of water from the AI DCC MSF process is dependent on the plastic used in the heat exchanger, the assumed life of plastic tubes, and fixed charge rate. If cross-linked polyethylene tubes become applicable, the process would be more economical than the combined VTE or MSF. (Davison-IPA)
W79-04521

STRUCTURE AND PROPERTIES OF REVERSE OSMOSIS MEMBRANES,
Aerojet-General Corp., Azusa, CA.
B. Keilin, C.W. Saltonstall, W. S. Higley, R. E.

Kesting, and A. L. Vincent.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-177 081, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 154, November 1965. 75 p, 26 fig, 10 tab, 24 ref. 14-01-0001-338.

Descriptors: *Membrane processes, *Reverse osmosis, *Desalination, *Cellulose acetate, Mechanical properties, Structure, Kinetics, Evaluation, Separation techniques, Strength, Pressure, Osmotic pressure, Water quality control, Desalination apparatus, Semipermeable membranes, Desalination processes, Water purification, Water treatment.

A study of the fundamental aspects of cellulose acetate membrane preparation, structure, and properties is reported. Major attention was given to quantitative measurements for transport mechanism and for membrane structure studies. Transport studies were concerned with clarifying the detailed mechanism of desalination by reverse osmosis through the measurement of process kinetics. In membrane structure studies, the relationship between preparative variables and mechanical properties of the membranes were evaluated, and an effort was made to correlate changes in osmotic properties with mechanical properties. An investigation of gel structure through light-scattering measurements on membrane casting solutions was undertaken. Major accomplishments over the past year in the following areas are examined: (1) activation energy in salt and water transport; (2) feed additives; (3) tensile properties; (4) compression properties; and (5) light-scattering measurements. (Davison-IPA)
W79-04664

REVERSE OSMOSIS MEMBRANES CONTAINING GRAPHITIC OXIDE,
Westinghouse Research Labs, Pittsburgh, PA.
L. C. Flowers, D. E. Sestrich, and D. Berg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-196 117, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 224, December 1966. 81 p, 17 fig, 16 tab, 50 ref. 14-01-0001-550.

Descriptors: *Desalination, *Graphitic oxide, *Desalination processes, *Reverse osmosis, *Membranes, Membrane processes, Semipermeable membranes, Pressure, Osmotic pressure, Desalination apparatus, Chemical analysis, Physical properties, Films, Fabrication, Organic compounds, Polymers.

Graphitic oxide (GO) sols were prepared and examined chemically and physically as first steps in determining whether GO could be used as membranes in the reverse osmosis process of desalination. Membrane fabrication techniques included: 'free films', obtained by air drying GO suspensions; 'suction filtering'; and pressure filtration. Of these, pressure filtration proved to be the most successful. Various porous supporting bases were tested separately under the same conditions the actual GO membranes undergo during reverse osmosis testing. The possibility of combining GO with organic polymers as binders in fabricating membranes was considered, and several bindes were prepared. Most were stored for future use, and only one, 150-minute CEPVA containing 6.6% nitrogen, was actually used. The reverse osmosis testing apparatus and experimental data are discussed, including membrane performance. It is concluded that GO membranes exhibit the essential properties characteristic of desalination membranes, but their water flux rates and salt rejection capabilities are lower that those for cellulose acetate. The study of GO membrane functions regarding reverse osmosis desalination is not sufficiently advanced to warrant a conclusive theory concerning their mechanism. (Davison-IPA)
W79-04665

THE MECHANISM OF MASS TRANSFER THROUGH A LIQUID INTERFACE,
Midwest Research Inst., Kansas City, MO.
A. E. Vandegrift.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-196 118, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 226, December 1966. 46 p, 46 fig, 2 tab, 4 ref, 2 append. 14-01-0001-656.

Descriptors: *Desalination, *Desalination processes, *Desalination apparatus, *Surface tension, *Mass transfer, Diffusion, Membrane processes, Interfaces, Saline-freshwater interfaces, Laboratory equipment, Laboratory tests, Water purification, Evaporation, Ammonia, Alcohols.

The oscillating jet method for dynamic surface tension was used to determine whether the presence of salt increased the interface resistance to mass transfer. Studies of the absorption of ammonia and ethyl alcohol into distilled water and salt water resulted in general information about the effect of dissolved salt on interface resistance, which may be applied to the evaporation of salt water. The technique used allowed the acquisition of the surface tension of a solution as it changed with time due to changes in the surface concentration or chemical potential. It is concluded that the addition of salt to distilled water does not increase interface resistance to mass transfer within the accuracy of this experimental method; theory and experiment do not agree on the rate of ammonia absorption; theory and experiment agree completely as to the adsorption of ethyl alcohol. The oscillating jet for gas absorption studies has proven feasible, so that it should be possible to obtain much fundamental information about the action of interface during mass transfer. (Davison-IPA)
W79-04666

DEVELOPMENT OF AN ANALYTICAL METHOD FOR MEASURING THE HYDROCARBON CONTENT IN WATER,
Koppers Co., Inc., Pittsburgh, PA.
M. A. Phillips, W. R. Holden, E. W. Albaugh, W. E. McKinstry, and H. A. Sweeney.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-166 253, Price codes: A06 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 115, November 1964. 70 p, 28 fig, 17 tab, 34 ref, 2 append. 14-01-001 204 and 14-01-0001-344.

Descriptors: *Desalination, *Analytical techniques, *Instrumentation, *Prototype tests, Prototypes, Potable water, Effluents, Saline water, Organic compounds, Ionization, Chemical analysis, Water purification, Brines, Calibrations, Desalination plants.

The development of an analytical method designed to measure the hydrocarbon content in potable water and reject brine streams emerging from saline water conversion pilot plants at the Research and Development Test Station, Wrightsville Beach, North Carolina is described. A prototype analytical hydrogen flame ionization detection unit was designed as the result of experimental work on developing this method. This prototype was used as a basis for the design of the hydrocarbon analyzer, which was constructed and installed in the Munroeville Research Center, after calibration for n-butane ranging from 0.05 to 2.0 ppm by weight in water. The following features of the analyzer were not included in the prototype: (1) compact installation in a console; (2) timing devices which permit automotive sampling and variation of the sampling time; (3) the recorder chart drive operates during the automatic or manual sampling periods only; (4) enclosure of the stripping unit and associated water lines within the console; and (5) provision for the introduction of a standard reference gas to the sampling system for checking the instrument calibration. It is concluded that the gas stripping unit has been found suitable for its proposed applications. (Davison-IPA)
W79-04667

BIBLIOGRAPHY OF THE LITERATURE ON DROPWISE CONDENSATION, 1930-64,
Franklin Inst., Philadelphia, PA.
R. A. Erb.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-166 269, Price codes: A02 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 119, August 1964. 14 p. 14-01-0001-293.

Descriptors: *Bibliographies, *Publications, *Dropwise condensation, *Condensation, *Desalination, Desalination processes, Distillation, Heat transfer, Saline water, Water treatment, Separation techniques, Steam, Heat transfer.

A compilation of references available in published literature directly concerned with dropwise condensation is presented. The publications are listed chronologically by year, and when two or more publications are listed for any year they are arranged alphabetically according to author. The letter in front of each entry classifies the emphasis in each document as follows: A emphasizes the mechanism of dropwise condensation; B emphasizes promoters for dropwise condensation; B emphasizes promoters for dropwise condensation; and C emphasizes heat transfer, or that the document is of a general nature. (Davison-IPA)
W79-04669

HEAT TRANSFER IN THE LIQUID-LIQUID SPRAY TOWER,
Dynatech Corp., Cambridge, MA.
S. P. Sukhatme, and M. Hurwitz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-116 315, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 120, October 1964. 55 p, 15 fig, 16 ref, 2 append. 14-01-0001-382.

Descriptors: *Desalination, *Desalination apparatus, *Spray tower, *Heat exchangers, Heat transfer, Correlation analysis, Laboratory tests, Flow, Dispersion, Electric current, Electrical equipment, Liquids, Oil-water interfaces, Mixing.

A study of the heat transfer performance of a spray tower which uses water and AMSCO oil, and the possible augmentation of the performance with electrohydrodynamic (EMD) means by reducing the drop size is reported. A spray tower is a special type of heat exchanger in which two countercurrent liquids are in direct contact instead of flowing through separate channels. The fluid flow and heat transfer inside a spray tower is analyzed, and the experimental loop built for determining the heat transfer correlations in a 3-in diameter spray tower is described. Tests conducted with both water and oil dispersed (with the water heated by the oil), show that the satisfactory operation of a spray tower requires the formation of uniformly sized drops at the distributor plate, so that there is no coalescence. It was also shown that the tower may be stably operated in a flooded state if a simple end design is used on the spray tower. The heat transfer results with water dispersed in oil indicate that it is advantageous to operate the tower in a flooded state; not enough data was obtained with oil dispersed in water to make a definite conclusion. The use of EHD techniques in spray towers is not recommended because of the nonuniformity of drop size produced at high voltages. (Davison-IPA)
W79-04670

THE KOPPERS HYDRATE PROCESS FOR SALINE WATER CONVERSION EXPERIMENTAL AND ENGINEERING STUDIES,
Koppers Co., Inc., Pittsburgh, PA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 577, Price codes: A06 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 90, March 1964. 114 p, 50 fig, 3 tab, 32 ref, 1 append. 14-01-0001-204.

Descriptors: *Desalination, *Desalination processes, *Kopper Hydrate Process, Chemical precipitation, Filtration, Hydrates, Hydrate processes, Saline water systems, Crystallization, Separation techniques, Laboratory tests, Sea water, Sands, Potable water.

Laboratory work was performed to establish the technical and economic feasibility of the Koppers Hydrate Process as a means of desalinating sea water. This process is a chemical process, whereby a hydrating agent, such as propane or dichlorodifluoro-methane, and water combine to form insoluble crystals. The crystals, filtered from mother liquor, are washed free, and decomposed into salt free water and the liquid hydrating agent which is recycled. The work was carried out on bench-scale equipment, which included a 10-gallon reactor crystallizer with a capacity equivalent to 150 gallons of potable water/24 hours. Synthetic sea water and various hydrating agents, particularly propane, were used to prove the technical feasibility of the process. Filtration studies showed that it was possible to wash the crystals sufficiently free of brine, so that upon decomposition by contact with hot vapors of the agent, potable water can be produced. Filtering and washing equipment were evaluated through batch filtration and washing experiments using various hydrate crystals and sand. Consistant results were obtained with sand and hydrate crystals through a 12-in square filter at varying bed depths. The flexibility of this process, as related to the physical properties of the hydrating agents and the temperature and pressure chosen for any particular agent, offers possibilities for cost reductions. It is concluded that this process will develop into an economically attractive desalination process. (Davison-IPA)
W79-04671

MECHANISM OF ELECTRODE DEMINERALIZATION,
Rockwell International, Canoga Park, CA. Rocketdyne Div.
J. Farrar, S. Evans, and G. D. Seele.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-166 404, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 126, January 1965. 44 p, 19 fig, 7 tab, 4 ref. 14-01-0001-334.

Descriptors: *Desalination, *Desalination processes, *Demineralization, *Electrolysis, Electrodes, Desalination apparatus, Electrochemistry, Electrodialysis, Ions, Water quality control, Separation techniques, Adsorption, Laboratory equipment, Electric currents.

Demineralization electrodes were studied in half cells to characterize, electro-chemically, the individual electrodes, and in complete cells to determine overall polarization and exchange characteristics. A three electrode system was used in the half cell studies, and the potential of the test electrode was measured with respect to a reference electrode. Coulometric and potentiostatic techniques were used. The electrodes studied were a (1) Dacron felt impregnated with carbon, and (2) an aqueous paste of carbon or graphite. Polarization data, determined using steady state techniques, voltammetry at linearly changing potentials, and chronopotentiometry, indicated no evidence for redox processes below potentials corresponding to the decomposition of water. The results of complete cell coulometric experiments show a correlation between current passed and uptake or release of ions. For all experiments, the average exchange efficiency was 25%. The exchange efficiency seems to be relatively independent of the number of coulombs passed, and very dependent on factors such as calendering, abrasion of graphite backing, and previous use of the electrodes. The demineralization process is not limited by transport to one or both of the electrodes. current reversal caused a regeneration of the salt concentration in the solution. When the potential was removed from the demineralization cell, the potential decreased, and ions were transferred back into solution, inferring an electrically induced physical adsorption. (Davison-IPA)
W79-04672

NUCLEATION AND GROWTH OF ICE CRYSTALS,
Rockwell International, Canoga Park, CA. Rocketdyne Div.
J. Farrar, and W. W. Hamilton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-166 405, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 127, January 1965. 57 p, 11 fig, 6 tab, 47 ref, 1 append. 14-01-0001-333.

Descriptors: *Desalination, *Desalination processes, *Nucleation, *Crystal growth, Ice-water interfaces, Saline water, Supercooling, Freezing, Water cooling, Crystallization, Water purification, Boundaries, Interfaces, Growth rates, Free energy.

Background information on nucleation in supercooled water and ice crystal growth are presented in a study of two different aspects of ice formation: (1) growth of ice crystals, and (2) supercooling of water and nucleation of ice. The rate of crystal growth was studied as a function of the temperature, salt concentration, liquid flow velocity, and additives. It was found that crystal growth velocities were different along the two major axis. This anistrophism is more apparent in saline solutions, along the two major axis. This anistrophism is more apparent in saline solutions, and can account for difficulties in freezing operations. Growth along the A-axis is unaffected by salt or additives, and is largely under thermal control, while growth along the C-axis is strongly inhibited by salts and additives. Raw sea water did not nucleate easily. Some droplets could be cooled below-23.5C without freezing. Larger masses of sea water, when stirred, required less supercooling. The free energy of ice water interfaces is important in ice nucleation and crystal growth. Data from this study were analyzed and correlated with physical constants in mathematical models. (Davison-IPA)
W79-04673

WASHING OF BRINE FROM ICE CRYSTALS,
Massachusetts Inst. of Technology, Cambridge.
J. P. Leinroth, Jr., W. P. White, T. K. Sherwood, and P. L. T. Brian.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-166 401, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 128, January 1965. 82 p, 61 fig, 3 tab, 17 ref, 2 append. 14-01-0001-295.

Descriptors: *Desalination, *Desalination, *Desalination processes, *Freezing, *Ice washing, Separation techniques, Brines, Saline waters, Ice-brine systems, Slush, Crystals, Water treatment, Particle size, Particle shape.

The results of an experimental and theoretical study of the removal of brine from ice-brine slush by countercurrent washing are presented. Two separate investigations were performed: (1) the washing of brine from plastic and glass beads, which permitted investigation of the basic factors involved without the complications due to freezing and melting of ice; and (2) the batch washing of brine from a mass of small ice crystals. The data are analyzed in terms of a longitudinal-dispersion model which describes the blending of water and brine at the moving wash-water front. The results support the validity of the model as a basis for correlating and interpreting ice washing data. The least loss of water occurs if long columns are used without agitation of the bed. Washing performance, more effective in flooded than in drained beds, improves as the wash rate is reduced. The wash rates operable without ice entrainment in the brine effluent decrease as the size of the particles is decreased. Because brine readily drains from beds containing large particles, it may pove both practical and desirable to produce large ice particles and drain the brine before washing with piston-flow of wash water. (Davison-IPA)
W79-04674

A STUDY OF MEMBRANES FOR DESALINATION BY REVERSE OSMOSIS,
Aerojet-General Corp., Azusa, CA.
C. W. Saltonstall, Jr., F. C. Burnett, W. S. Higley, W. M. King, and A. L. Vincent.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-190 061, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 232, January 1967. 80 p, 29 fig, 8 tab, 25 ref. 14-01-0001-338.

Descriptors: *Desalination, *Desalination processes, *Membranes, *Membrane processes, *Reverse osmosis, Physical properties, Movement, Kinetics, Semipermeable membranes, Mechanical properties, Cellulose acetate, Polymers, Heat treatment, Permeability, Anions, Electrical resistance, Water treatment.

Accomplishments during 1966 on reverse osmosis membrane research are reported. Measurements on the active layer of reverse osmosis membranes are emphasized as part of a program to determine the relationship between osmotic properties and aspects of casting solution and membrane structure. A detailed investigation of the change in active layer properties during the annealing stage of its formation was performed, and an electrical conductivity technique for determining the permeability of the active layer was developed. Measurements made on swollen cellulose acetate membranes show that only the active layer offers significant electrical resistance. Studies show that heat treatment of swollen membranes is a two-step process. The initial rapid step is short, wherein most changes in osmotic properties and water content occur; in the second step, further changes occur at a greatly reduced rate. Membranes heat treated at 85C allowed 1.6% permeation of sodium chloride and only 0.16% calcium chloride permeation. An investigation of the kinetics of transport across cellulose acetate membranes has shown that the activation energy of water transport is independent of pressure and feed solution type and concentration. It was also shown that the anion of a solute is the most important species in determining solute permeation. Decreases in the compressive yield point of a cellulose acetate membrane resulted from decreased strain rates in the compression on measurements. (Davison-IPA)
W79-04675

USE OF WASTE HEAT FOR PRODUCTION OF FRESH WATER,
Burns and Roe, Inc., Oradell, NJ.
H. Gitterman, and S. Zwickler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-196 119, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 235, December 1966. 83 p, 21 fig, 12 tab, 32 ref. 14-01-0001-683.

Descriptors: *Desalination, *Desalination plants, *Industrial wastes, Gases, Liquid wastes, Energy, Energy conversion, Incineration, Wastes, Economics, Costs, Comparative costs, Water rates, Water supply, Water purification, Water treatment.

The economic advantages of using waste heat to provide the necessary energy and/or power to produce fresh water is evaluated. Waste heat is heat generated in excess of process requirements which is discharged to the surroundings as high temperature liquid, vapor, or gas. In industrial operations practicing recovery of waste heat, the practice has proven to be economical. For example, the generated gas of sewage plants is utilized to provide power directly by driving prime movers to satisfy inplant requirements. A survey was made of industries having waste heat available, and these sources were located geographically to determine the availability of waste heat near raw water sources and population centers. These waste heat souces include: refuse incineration, sewage incineration, cement plants, glass furnaces, foundries, industrial incinerators, and other industrial sources. The water sources, groundwater, surface water, and sea water, are also located geographically, and the solids in some typical surface water supplies are tabulated. The cost of available fresh water is discussed in comparison with the cost of desalinated water. It is indicated that the use of waste heat as an energy source for desalination plants may bring the cost of the product to a level competitive with other water supplies. Water costs

in U.S. communities are tabulated. Desalinated water costs using waste heat to supply energy were calculated and tabulated. (Davison-IPA)
W79-04676

CORROSION TEST PROGRAM,
Rice (Cyrus Wm.) and Co., Pittsburgh, PA.
W. F. Dietrich.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-192 496, Price codes: A08 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 244, February 1967. 147 p, 17 fig, 12 tab, 60 ref, 1 append. 14-01-0001-768.

Descriptors: *Corrosion, *Desalination, *Desalination plants, *Saline water, *Construction materials, Evaluation, Data collections, Chemical properties, Chemical reactions, Dissolved oxygen, Distillation, Saline water, Temperature, Laboratory tests, Desalination processes, Potable water.

The information and data concerning corrosion which existed or resulted from the operation of the various desalination demonstration plants has been compiled and evaluated. The work also includes a compilation of: (1) an evaluated list of construction materials; (2) requirements for additional in-plant studies of construction materials; and (3) requirements for additional laboratory or pilot plant studies of construction materials. Test programs designed to provide data for the evaluation of construction materials, which come in contact with saline water, product water, and potable water as a blend of municipal water with product water, are presented. This study was accomplished through a literature search, site visits, and interviews with industry representatives having interest in saline water conversion efforts. It was found that the high temperature distillation type process has experienced the most harmful effects of corrosion; membrane and freezing type processes have been relatively unaffected. This work emphasizes the high temperature distillation processes. The variables, pH, the dissolved oxygen content in the saline water, and temperature are considered regarding corrosion. Dissolved oxygen, the most difficult variable to control, is theoretically most closely associated with corrosion. Background information on the various demonstration plants is provided; theoretical concepts of the electrochemical nature of corrosion are reviewed; laboratory and field methods of corrosion control are described; and conclusions and recommendations are presented. (Davison-IPA)
W79-04677

SECOND REPORT ON FABRICATION AND EVALUATION OF NEW ULTRATHIN REVERSE OSMOSIS MEMBRANES,
Midwest Research Inst., Minnetonka, MN. North Star Div.
P. S. Francis, and J. E. Cadotte.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-182 881, Price codes: A04 in paper copy, A01 in microfiche. OSW Final Research and Development Progress Report No. 247, April 1967. 65 p, 8 fig, 17 tab, 11 ref, 1 append. 14-01-0001-457.

Descriptors: *Desalination, *Reverse osmosis, *Thin films, *Polymers, Organic compounds, Membrane processes, Membranes, Semipermeable membranes, Mass transfer, Structure, Cellulose, Desalination apparatus, Desalination processes, Materials testing, Research and development, Water purification, Water quality control, Flow rates, Separation techniques.

A new class of high-performance desalination polymers resulted from a study of the desalination properties of cellulose acetate as affected by their polymer structure. Acetates of other polysaccharides, widely divergent in structure, were prepared and tested in reverse osmosis. All gave good salt rejection, and were within the same order of magnitude in water flux. Mixtures of these acetates, such as a 1:1 mixture of cellulose triacetate and xylan acetate gave basically the same desalination properties. It is indicated that polymer structure and form are minor factors for water transport by cellulose acetate. Xylan acetate and Beta-glucan acetate gave higher water flux than cellulose triacetate. The effects of the cellulose substituents were determined by preparing an ultrathin membrane from the desired cellulose derivative, and evaluating it for reverse osmosis. These derivatives were made by direct substitution of cellulose or by using a cellulose diacetate or dimethyl cellulose and substituting the remaining hydroxyl groups with the desired groups. It is concluded that: (1) cellulose triacetate gave very favorable desalination results as an ultrathin membrane; (2) addition of substituents with any alkyl group larger than one carbon atom always decreased the promoting water transport are those containing several oxygen, nitrogen or sulfur atoms closely grouped; and (4) cellulose methyl ethers show similar water transport rates to cellulose acetate. (Davison-IPA)
W79-04678

PERMEABILITY REQUIREMENTS OF MEMBRANES FOR USE IN DESALINATION BY REVERSE OSMOSIS,
Office of Water Research and Technology, Washington, DC. Biosciences Div.
H. E. Podall.
OSW Research and Development Progress Report No. 255, July 1967. 45 p, 13 fig, 4 tab, 13 ref.

Descriptors: *Membranes, *Reverse osmosis, *Desalination apparatus, Water treatment, Water treatment, Water purification, Permeability, Water properties, Diffusion.

The intrinsic permeability requirements of membranes to be used in the reverse osmosis process of desalination are quantitatively defined in terms of basic process parameters. These parameters include the initial feed concentration, required salt rejection efficiency, water product flux, volume percent water recovery, and the applied pressure. A simple diffusion model for calculating the water and salt fluxes was used to calculate the permselectivity and intrinsic water permeability of the membrane regarding the basic parameters. It was assumed that the fluxes were uncoupled or independent of each other. Examples of the requirements for three given feed concentrations under various process conditions are tabulated. (Davison-IPA)
W79-04679

INVESTIGATION OF THE REMOVAL OF TRACE TOXIC HEAVY METAL IONS FROM WASTE WATER BY FOAM FRACTIONATION,
Polytechnic Inst. of New York, Brooklyn. Dept. of Chemistry.
For primary bibliographic entry see Field 5D.
W79-04754

WATER PURIFICATION BY REVERSE OSMOSIS,
Ocean Water Ltd., Nassau (Bahamas). (Assignee).
L. P. S. Wilson.
U.S. Patent No. 4,124,488, 11 p, 7 fig, 15 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 1, p 232-233, November 7, 1978.

Descriptors: *Patents, *Desalination, *Water treatment, *Water purification, Reverse osmosis, Membrane processes, Pressure, Pistons, Desalination apparatus.

An apparatus for reverse osmosis purification of water or other fluid by passing the fluid under pressure across a membrane, through which membrane a part of the fluid passes in purified form, makes use of a piston or diaphragm pump in which the front face of the piston or diaphragm is used to force the fluid from one end of a cylinder into the module and in which the return fluid is applied to the rear face of the piston or diaphragm so that the pressures on the two faces are substantially balanced. The piston of diaphragm is operated by a piston rod attached to the rear face of the piston or diaphragm. The system is self-regulating to give an extraction ratio equal to the ratio of piston rod area to piston area. (Sinha-OEIS)
W79-04887

REVERSE OSMOSIS DESALINATION APPARATUS AND METHOD,
J. W. Chenoweth.
U.S. Patent No. 4,125,463, 8 p, 3 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 976, No 2, p 566, November 14, 1979.

Descriptors: *Patents, *Desalination, *Reverse osmosis, *Desalination apparatus, Water purification, Water treatment, Saline water, Membrane processes, Hydrostatic pressure, Separation techniques.

A reverse osmosis desalination system and its method of operation is disclosed which takes advantage of the hydrostatic head of salt water for providing the differential pressures necessary for osmotic separation. The first step is drilling a well to a predetermined depth in a conventional manner. A casing member is instaled in the well hole and a smaller conductor member is placed within the casing, leaving an annular space. Attached to the lower end of the conductor member is a permeator assembly which may include one or more units having osmotic membranes responsive to predetermined differential pressures for separating salt water into salt free water and concentrated salt water. The depth of the well and the depth at which the permeator assembly is placed is such that the static head of salt water in the annular space between the casing and conductor members is great enough to create the necessary differential pressure for effecting the necessary osmotic separation. A tubular production member is placed within the well with a pump attached to the lower end for pumping the salt-free water to the surface of the well. The concentrated salt water is allowed to exit the well through the conductor member. (Sinha-OEIS)
W79-04898

STUDY OF MULTI-PHASE EJECTORS FOR FREEZING PROCESS DESALINATION SYSTEMS,
Kaye (Joseph) and Co., Inc., Cambridge, MA.
C. A. Kemper, G. F. Harper, S. W. Gouse, and J. H. Leigh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-166 256, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 118, May 1964. 56 p, 13 fig, 12 ref, 3 append. 14-01-0001-373.

Descriptors: *Desalination, *Flash distillation, *Ice-brine systems, *Multiple-Phase Ejector desalination systems, *Desalination processes, Flash freezing, Evaporators, Equipment, Saline water, Sea water, Water purification, Water treatment, Water quality, Water quality control, Freezing.

The results of a theoretical study of the direct contact freezing process and the flash evaporation freezing process in Multiple-Phase Ejector (MPE) desalination systems are reported. Both systems had two refrigeration cycles using normal-butane as a refrigerant. The low temperature cycle carries out the freezing process, and the high temperature cycle rejects losses and work-inputs as heat to the environment. To compare the results from the study with published data on conventional systems, a single freezer temperataure of 25F was selected. The effects of ice-brine separator efficiency, pump efficiencies, viscous friction, and irreversible mixing processes in the MPE are considered. In establishing a baseline, an ideal reversible freezing process desalination system was compared to the ideal direct contact freezing MPE desalination systems. The results indicate work-input of: 2.56 Btu/16m of fresh water for the ideal direct contact system and 2.29 Btu/lbm of fresh water for the ideal reversible freezing system. It is concluded that increasing the size of the MPE mixing section improves the performance. (Davison-IPA)
W79-04935

THE ZONE-PURIFICATION PROCESS AS A METHOD OF PREPARATION OF POTABLE WATER FROM SEA WATER,
Battelle Memorial Inst., Columbus, OH.
S. E. Miller, R. C. Himes, and H. L. Goering.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 392, Price codes: A02 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 17, January 1958. 15 p, 2 fig, 1 tab. 14-01-001-80.

Descriptors: *Desalination, *Desalination processes, *Zone freezing, Freezing, Water purification, Potable water, Crystal growth, Crystallization, Demineralization, Ice-water interfaces, Sea water, Saline water, Water properties, Water treatment, Water quality, Water quality control.

A study to determine the feasibility of zone freezing for the purification of saline water is reported. A refrigeration and freezing apparatus was devised whereby continuous, direct visual observations of the freezing system were possible. Dye introduced into the sodium chloride solution facilitated the visual observation of the progress of directional freezing. Microscopic and analytical studies of the nature of ice laid down from salt solutions at various rates and concentrations, and under varying degrees of agitation revealed that good clear ice may be crystallized at reasonable high rates from dilute solutions, but the rate at which the ice crystals are grown is suppressed as solution concentration is increased. Trapping of salt in the solid mass occurs when the natural crystallization rate is exceeded, or when continued growth of the individual crystallites encroach upon one another. It is concluded that the shape of the solid-liquid interface, and natural crystallization rates at various solution concentrations are important factors in determining segregation efficiencies. With a single directional freeze it was possible to regularly remove more than 99.9% of salt from solutions containing up to 20 grams of salt/liter. In solutions containing 20 to 30 grams/liter 97.5% removals were effected, and in solutions containing 30 to 70 grams/liter, 82% removal was made. Potable water containing less than 50 ppm total salt concentration was produced from a two-stage program in directional freezing experiments on sea water. (Davison-IPA)
W79-04936

WATER AND ION FLOW THROUGH IMPERFECT OSMOTIC MEMBRANES,
Florida Univ., Gainesville. Dept. of Chemistry.
E. J. Breton, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 391, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 16, April 1957. 73 p, 26 fig, 3 tab, 44 ref, 1 append. 14-01-001-79.

Descriptors: *Semipermeable membranes, *Cellulose acetate, *Reverse osmosis, *Desalination apparatus, Osmotic pressure, Osmosis, Chemical reactions, Membrane processes, X-ray diffraction, Saline water, Laboratory tests, Water purification, Ions, Ion transport, Diffusion, Electrolysis.

To explain the behavior of cellulose acetate as a semipermeable membrane in saline water, several hypotheses concerning two different mechanisms for the transfer of water through these membranes were formulated. The most important evidence supporting the hypotheses was obtained from resistance experiments, wherein the resistance of specific ions was measured across cellulose acetate at various pressures. The resulting resistance-pressure relationship are correlated with the semipermeability of the cellulose acetate. X-ray diffraction and birefringence measurements were used to show the extensive structural changes, due to a chemical reaction between the solute and cellulose acetate, which occurs when the film ceases to behave as a semipermeable membrane. Specific recommendations for an improved semipermeable membrane are presented. A literature review, semipermeable tests, and the theory for the semi-permeability of cellulose acetate are examined. (Davison-IPA)
W79-04937

STUDY OF THE APPLICABILITY OF COMBINING NUCLEAR REACTORS WITH SALINE WATER DISTILLATION PROCESSES,
Fluor Corp., Whittier, CA.
D. B. Brice, M. R. Dusabek, and C. R. Townsend.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 062, Price codes: A10 in paper copy, A01 in microfiche. OSW Final Research and Development Progress Report No. 19. 219 p, 29 fig, 55 tab, 19 ref, 8 append. 14-01-001-97.

Descriptors: *Desalination processes, *Nuclear reactors, *Desalination plants, *Distillation, *Evaporators, *Operating costs, *Capital costs, Long-tube vertical distillation, Sea water, Vapor compression distillation, Water purification, Water treatment, Water quality control, Nuclear energy, Steam, Condensation.

A detailed economic and technical analysis of the heavy-water moderated and cooled reactor, and a technical analysis of a combination multiple-effect and multi-stage flash evaporator system are presented in the first part of this report. A discussion of the nuclear steam generating system includes descriptions of the nuclear reactor and its performance. Operating costs and reactor capital charges are examined, and include fuel element fabrication and reprocessing costs, uranium depletion and plutonium credit, and inventory charges. Costs of water from a combination long-tube vertical multiple-effect and multi-stage evaporator system were estimated; all data is tabulated. The study indicates that sea water can be converted in the range of 52 to 63 cents/thousand gallons in a 50 million gallon/day distillation plant using steam from a nuclear reactor. Part two consists of a summary report as an appendix, and contains the earlier research carried out on this project. Nuclear steam generating systems are described. The following distillation processes are discussed: (1) multiple effect evaporation; (2) multiple stage flash; (3) air-water direct contact; and (4) vapor compression distillation. Water costs, including capital and operating costs, for these processes are tabulated. Results of the entire study indicate that the two combination reactor-distillation systems considered as optimum are the heavy-water moderate and cooled reactor or the light-water moderated and cooled, slightly enriched reactor combined with a combination multiple-effect and multi-stage flash evaporator, or a long-tube vertical multiple-effect evaporator system. (Davison-IAP)
W79-04938

ECONOMIC EVALUATION STUDY OF DISTILLATION OF SALINE WATER BY MEANS OF FORCED-CIRCULATION VAPOR-COMPRESSION DISTILLATION EQUIPMENT,
B. F. Dodge, and A. M. Eshaya.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 395, Price codes: A09 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 21. 132 p, 60 fig, 29 tab, 38 ref. 14-01-001-101.

Descriptors: *Desalination, *Distillation, *Dropwise condensation, *Vapor compression distillation, *Economics, *Economic evaluation, Capital costs, Desalination plants, Desalination apparatus, Heat exchangers, Heat transfer, Scaling, Fixed costs.

A study to determine the economically optimum combination of the independent variables in a vapor compression cycle with forced circulation and dropwise condensation for desalination is reported. The following variables were considered: (1) brine velocity in tubes; (2) flashing fraction; (3) tube diameter, thickness, and type of exchanger; (4) temperature approaches in the main heat exchanger; (5) temperature approaches in the auxiliary exchangers; (6) pressure in the main heat exchanger; and (7) relationship of fixed charges, and energy costs to each other and to total costs. Because the optimum combination of variables may depend on the size of the plant, the following sizes were considered: 100,000 gpd; 1,000,000 gpd; and 10,000,000 gpd. The experimental and theoretical evidence indicate the dropwise condensation and forced-circulation will result in increasing the overall heat transfer coefficient in industrial distillation equipment by a factor of three to four. Forced-circulation is expected to improve the retardation of, or eliminate scale formation, particularly if the liquid is flashed in a chamber separate from the heat exchanger. At the optimum combination of variables the cost of the product ranges from $0.69 to $0.86/1000 gal for a 10,000,000 gpd plant, and capital costs range from $1.60 to $2.09/gpd, correspondingly. (Davison-IPA)
W79-04939

ENERGY AND MASS TRANSFER IN PARTIAL-PRESSURE DISTILLATION,
Wisconsin Univ.-Madison.
J. E. Davis, O. G. Lof, and J. A. Duffie.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-166 408, Price codes; A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 131, November 1964. Annual Report Ending September 1, 1964. 54 p, 7 fig, 2 tab, 63 ref, 2 append. 14-01-0001-277.

Descriptors: *Mass transfer, *Distillation, *Solar distillation, *Desalination, Desalination processes, Separation techniques, Water purification, Water treatment, Saline water, Solar stills, Humidification, Water vapor, Evaporation, Condensation, Energy transfer, Conduction, Diffusion.

The work, to date, on an investigation of the transfer of water vapor across an air space between two parallel plane surfaces, where water is evaporating from one surface, and water vapor is condensing on the other, is reported. The relationship between transfer rates and the following variables is being examined; (1) temperature difference between the two surfaces; (2) temperature level of the gas layer; (3) the height to thickness ratio of the gas layer; and (4) orientation of the gas layer in relation to the vertical. A survey of the previous work in energy and mass transfer in solar distillation of saline water, film condensation, and convection phenomena is presented. The theoretical analysis results in the development of two sets of steady state transfer equations: (1) applicable to a conduction-diffusion process; and (2) applicable to a convection process involving temperature and concentration gradients at boundary layers adjacent to each plate. The experimental equipment is described, and accompanied by a flow diagram. Preliminary testing has established the minor design changes. Objectives of further preliminary testing include the achievement of satisfactory plate wetting, and accurate, reproducible temperature difference measurements. Actual distillation experiments will begin after 'dry runs' are made to calibrate the thermally insulated apparatus for heat losses to the surroundings. (Davison-IAP)
W79-04940

THERMODYNAMIC PROPERTIES OF SALINE WATER,
Monsanto Research Corp., Everett, MA.
B. M. Fabuss.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-178 986, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 136, July 1965. 66 p, 7 fig, 30 tab, 13 ref. 14-01-0001-294.

Descriptors: *Saline water, *Thermodynamics, *Physicochemical properties, Density, Vapor pressure, Desalination, Desalination processes, Correlation analysis, Mathematics, Equations, Water quality, Water analysis, Water properties.

Density measurements of water solutions of NaCl, KCl, NaSO4, MgSO4 and their ternary combinations were taken at 25 to 175C. The experimental density data were correlated; computational methods and equations were developed to calculate densities and partial molal values at other than measured concentrations and temperatures. The calculated density data agreed with the measured densities and with data published in International Critical Tables. The average standard deviation of

both experimental and calculated data for the four salts at all concentrations investigated over the given temperature range is about plus or minus 2.6 X 10-4 density units. Data from density measurements of the ternary solutions were correlated using apparent molal volumes. An equation using one interaction coefficient expressed the quantitative relationships in these systems. The average deviation for 54 ternary systems at the given temperature range was plus or minus 3.5 x 10-4 density units. Vapor pressure measurements on binary solutions of the given concentrations were taken at 25 to 150C. Vapor pressures of sodium chloride water solutions and activities of water are tabulated. (Davison-IPA)
W79-04941

INVESTIGATION OF INORGANIC ION EXCHANGE MEMBRANES FOR ELECTRODIALYSIS APPLICATION,
Douglas Aircraft Co., Inc., Newport Beach, CA. Astropower Lab.
C. Berger, R. Hubata, and M. Plizga.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-182 318, Price codes: A06 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 138, April 1965. 112 p, 22 fig, 32 tab, 32 ref. 14-01-0001-368.

Descriptors: *Membranes, *Ion exchange, *Inorganic compounds, *Electrodialysis, Desalination, Desalination processes, Films, Gels, Separation techniques, Anion exchange, Cation exchanges, Ion transport, Desalination apparatus, Laboratory testing, Electrochemistry.

A project undertaken to investigate the basic properties of inorganic ion exchanges and to study their fabrication into membranes to be used in electrodialysis is reported. Phase I of the two-phase program was concerned with the study of hydrous oxides and acid salts and the synthesis and study of anion exchangers. The three categories of anion exchangers distinguished were: (1) homogenous hydrous oxides; (2) heterogenous or 'mixed' hydrous oxides; and (3) basic salts. Of these, zirconium phosphate appeared to be the most promising, with an observed cation exchange capacity of 3.2 meg/gram at pH 6.6. A variety of techniques was used to fabricate coherent inorganic anion exchange membranes, and testing of these membranes yielded promising results in terms of strength, conductivity, and resistance to back-diffusion. The membrane forms retained the high anion exchange capacities exhibited by the original gels. When one membrane was tested in an electrochemical transference cell, a transport number of 0.76 was obtained, which established the ion selectivity of the membrane. (Davison-IPA)
W79-04942

SALINE WATER CONVERSION DEMONSTRATION PLANT, POINT LOMA I, SAN DIEGO, CALIFORNIA: SECOND ANNUAL REPORT.
Burns and Roe, Inc., New York.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-166 247, Price codes: A13 in paper copy, A01 in microfiche. OSW Final Research and Development Progress Report No. 114, July 1964. 218 p, 7 fig, 20 tab, 5 append. 14-01-0001-233.

Descriptors: *Desalination plants, *Demonstration Plant No. 2, *Flash distillation, Facilities, Water treatment, Saline water, Sea water, Evaluation, Heat transfer, Operation and maintenance, Productivity, Computer programs, Pumps, Equipment, Costs, Operating costs, Capital costs, Maintenance costs, Point Loma, San Diego(California).

The San Diego Demonstration Plant No. 2, a flash distillation plant, was designed to produce 1 million gpd with a brine heater outlet temperature of 200F. A peak of 1,400,529 gallons was achieved in one 24 hour period with a brine heater outlet temperature of 240F. Information is provided for the final operation period of July 1, 1963 through February 26, 1964. A report of the organization and plant operation and maintenance includes organizational charts and a flow diagram of the plant. In evaluating the evaporators the following parameters are covered: heat transfer, performance, brine flow, venting, foaming, and the computer program. Other design features evaluated are: deaerator, air ejector, pumps, brine heater, auxiliary equipment, and sea water intake. Actual capital and operating costs and theoretical capital and operating cost for a normalized plant are presented. Monthly production and costs and cost of water/1000 gallons are tabulated, with and without amortization, for the entire operating period from March 1962 through February 1964. Monthly and daily production are illustrated with graphs and tables. (Davison-IPA)
W79-04943

RECOMMENDED PROCEDURES FOR THE TESTING AND EVALUATION OF CANDIDATE REVERSE OSMOSIS MEMBRANES FOR DESALINATION,
Office of Water Research and Technology, Washington, DC. Polymer and Biophysics Div.
H. E. Podall, and J. M. Shackelford.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-182 766, Price codes: A02 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 268, September 1967. 20 p, 4 fig, 5 ref.

Descriptors: *Membranes, *Reverse osmosis, *Evaluation, *Membrane processes, *Testing procedures, *Laboratory tests, Laboratory equipment, Saline water, Brackish water, Desalination, Desalination apparatus, Films, Filters, Osmosis, Semipermeable membranes.

The best test of a reverse osmosis membrane is its assessed performance in the field on a given feed water. However, in developing new or improved membranes, laboratory testing under well defined conditions is desirable to precisely assess the effect of various feed water and process parameter variations. A discussion of process parameters, performance parameters, and intrinsic transport properties is followed by a presentation of experimental evaluation procedures. Typical cell designs and the recommended reverse osmosis test loop with a flat reverse osmosis test cell are illustrated. Necessary equipment tested by laboratory operation includes: pumps accumulator, high pressure lines, values, flow meter, pressure gauge, filter, porous metal plate, pressure relief value, and pressure regulator. Recommended test conditions and the determination of transport properties are presented. (Davison-IPA)
W79-04944

BIBLIOGRAPHY OF MEMBRANE TECHNOLOGY PERTAINING TO SALINE WATER DESALINATION: PART II.
Office of Water Research and Technology, Washington, DC. Biosciences Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-177 080, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development and Progress Report No. 153, November 1965. Compiled by Shackelford, J. M., and Kase, K. A. 56 p.

Descriptors: *Bibliographies, *Publications, *Patents, Documentation, Foreign projects, Desalination, Membranes, Membranes processes, Desalination apparatus, Desalination processes, Saline water, Water purification, Water treatment, Water quality, Water quality control.

A continuation of the Office of Saline Water Research and Development Progress Report No. 83, 'Bibliography of Membrane Technology Pertaining to Saline Water Desalination' is presented. The bibliography is in two parts: Part I contains literature references; Part II lists patents from the U.S., Britain, Japan, Australia, Belgium, Netherlands, France, Germany (West), Germany (East), Hungary, and U.S.S.R. (Davison-IPA)
W79-04945

BY-PRODUCTS FROM SALINE WATER CONVERSION PLANTS: A FEASIBILITY STUDY,
American Cyanamid Co., Stamford, CT.
A. J. Weingerger, and D. F. DeLapp.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 695, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 110, September 1964. 14-01-0001-308.

Descriptors: *Desalination plants, *Saline water, *Byproducts, Capital costs, Descaling, Separation techniques, Sea water, Brackish water, Prices, Mineralogy, Chlorine, Bromine.

A survey with the objective of determining if the recovery of salable byproducts from minerals contained in saline waters could be practical in reducing the overall cost of converting saline water to fresh water is reported. Two novel integrated descaling and byproduct recovery processes for sea water conversion which show the most promise for reducing water conversion costs through the profitable sale of byproducts are examined. Since pre-softening of the feed water is an integral part of the water conversion process, there is no cost associated with either of the processes. Process I would produce bromine, magnesia, and refined salt. The byproducts from a 10 million gpd sea water conversion plant which could be sold at present bulk commercial prices and the would-be byproduct credit and capital requirements are tabulated. Chlorine, magnesia, bromine, and possibly refined salt would be produced by Process II. Because this process was developed late in the study, sufficient time was not available for the preparation of a preliminary estimate of the capital needed to build the required byproduct recovery plant. Process II appears more attractive due to the flexibility it allows in the choice of byproducts to be recovered. Other processes devised held lesser economical promise. It is concluded that sale of byproducts recovered from sea water conversion plant feed water has the technical and economic potential for reducing the overall cost of conversion. Inland waters were examined, and only a strong brine showed potential of economical recovery of byproducts. (Davison-IPA)
W79-04946

REVERSE OSMOSIS FIELD TESTING ON ACID MINE WATERS AT NORTON, WEST VIRGINIA,
Gulf General Atomic, Inc., San Diego, CA.
S. S. Kremer, A. Riedinger , J. H. Sleigh, and R. L. Truby.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-198 936, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 586, July 1970. 49 p, 5 fig, 13 tab, 2 ref, 1 append. 14-01-0001-1836.

Descriptors: *Acid mine water, *Desalination, *Reverse osmosis, *Gulf General Atomic high-flux perchlorate membrane, *Desalination apparatus, *Demineralization, Membranes, Membrane processes, Semipermeable membranes, Separation techniques, Mine wastes, Laboratory tests, Equipment, Laboratory equipment.

A 10,000 gpd reverse osmosis unit equipped with eighteen 50 sq ft modules was employed to study the demineralization of acid mine drainage by reverse osmosis. Tests were conducted to investigate additional operation of the reverse osmosis at recoveries higher than 75%, and to compare high-selectivity modules with high-flux modules, and 600 psi operation with 800 psi operation. A small reverse osmosis unit with 5.0 sq ft modules was used to compare the Gulf General Atomic high-flux perchlorate membrane with a commercial high-flux formamide membrane. The large high-flux modules exhibited comparable rejection and an increase in flux relative to the high-selectivity modules. There was no loss in rejection in operation at 800 psi when compared with 600 psi, but the effect of the increased pressure on flux is still unclear. Operation at 92% for recovery of feed water was easily achieved. The Gulf General Atomic high-flux perchlorate membrane exhibited

flux decline and rejection comparable to those of the commercial high-flux formamide membrane. Experiments on flux restoration by chemically treating the modules was successful. (Davison-IPA)
W79-04947

THE OSMIONIC PROCESS,
State Univ. of New York at Albany.
G. W. Murphy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 389, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 14, 1957. 71 p, 36 fig, 13 tab, 4 ref. 14-01-001-58.

Descriptors: *Membranes, *Osmionic membranes, *Osmosis, *Anion exchange, *Cation exchange, *Desalination apparatus, Desalination processes, Demineralization, Brackish water, Saline water, Equilibrium, Materials testing, Water purification, Water treatment, Sea water, Laboratory tests.

Research on the development of the basic theory for the single-effect osmionic cell is reported, followed by the extension of the theory to include multiple-effect cells and multiple-stage operation. The fabrication of the demineralization device is described. All experiments were carried out with commercial anion exchange membranes and cation exchange membranes. The experimental results include equilibrium and rate data over the concentration range 1,000 to 30,000 ppm of sodium chloride. Calculations are presented for typical cases. From these computations it is estimated that osmionic plant designs for brackish water based on either double-effect cells or double-stage operation of single-effect cells will require about 50% of the membrane area calculated for the single-effect, single-stage cell to produce the same amount of product water. Additional effects beyond two seem to have only a marginal advantage over the double-effect. For higher concentrations such as sea water, multiple-effects will be necessary. In designing a brackish water demineralization unit various membrane designs were considered, and all but 'Design C' were discarded. The development of laboratory osmionic cells of 'Design C' is presented in Part II of the report. The characterization and preparation of the membranes from four materials are described. The general properties of two of these membranes, poly-styrenesulfonic acid-dynel and polyvinylimidazole methiodide-dynel, are tabulated. (Davison-IPA)
W79-04948

DONNAN SOFTENING AS A PRETREATMENT TO DESALINATION PROCESSES,
Process Research, Inc., Cambridge, MA.
J. L. Eisenmann, and J. D. Smith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 919, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 506, February 1970. 79 p 32 fig, 9 tab, 1 append. 14-01-0001-1782.

Descriptors: *Desalination, *Desalination processes, *Pre-treatment(Water), Membranes, Membrane processes, Ion transport, Calcium chloride, Flow rates, Velocity, Laboratory equipment, Laboratory tests, Computer programs, Correlation analysis, Water purification.

A study of the feasibility of the Donnan softening technique in establishing calcium transport rates in the feed waters of desalination plants, and relating these transport rates to solution concentrations, hydrodynamics, and membrane properties is reported. Several laboratory test scale systems were constructed and operated. Calcium transport data was obtained from three membrane types over a concentration range from 100 ppm to 500 ppm. Two different flow path geometries and range of flow velocities from 0.5 to 100 cm/sec were obtained. A methodology was developed correlating the experimental results from the varying types of experiments using a mathematical programming technique and a digital computer. The correlations of the results led to the development of a preliminary design rationale for the process. The costs of water softening using the Donnan process were estimated from the process design examples. One example shows the total cost of 3.66 cent/1000 gal for removing 50% of the calcium and magnesium from Webster, South Dakota water. A flow sheet shows the Webster, South Dakota electrodialysis plant utilizing the Donnan softening technique in a pretreatment system. (Davison-IPA)
W79-04949

BEHAVIOR OF WATER IN VARIOUS STATES,
New Mexico Highlands Univ., Las Vegas.
For primary bibliographic entry see Field 1A.
W79-04951

TRANSPORT OF ELECTROLYTES THROUGH MEMBRANE SYSTEMS, SECOND ANNUAL REPORT,
Southern Research Inst., Birmingham, AL.
M. S. Mintz, and R. E. Lacey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-178 530, Price codes: A04 in paper copy, A01 in microfiche. Research and Development Progress Report No. 259, 1967. 51 p, 7 fig, 15 tab, 1 append. 14-01-0001-464.

Descriptors: *Membrane processes, *Phenomonological admittance coefficients, *Electrolytes, *Ion transport, Membranes, Anions, Cations, Desalination, Desalination apparatus, Films, Laboratory tests, Permeability, Properties, Diffusion, Permselective membranes, Osmosis, Dialysis, Demineralization.

Research involving the calculation of admittance coefficients from improved experimental data, and the development of a method for predicting ionic transference numbers is reported. In using the improved experimental data, the characterization, under dynamic conditions, of the eight original membranes was extended to broader ranges of current densities in sodium chloride solutions. An additional four membranes were characterized under static and dynamic conditions. The additional membranes selected for study were: a silicone treated parchment, a denitrated nitro-cellulose, a cation-selective membrane, and an anion-selective membrane. In using the method for predicting ionic transference numbers, the values of transference numbers of sodium and chloride ions in near-neutral membrane systems predicted from data taken from potassium chloride solutions agreed with the experimentally measured ionic transference numbers. Preliminary studies were made of two different methods of arranging cation-selection and non-selective membranes for potential use in demineralization devices. Both arrangements are described. Most of the membranes studied exhibited an inverse relationship between water transference number, tau3, and current density; the cation transference number, tau1, decreased as the solution concentration increased. The value of tau1 of the near neutral membranes decreased at high densities as the current densities increased. (Davison-IPA)
W79-04952

FOURTH ANNUAL REPORT: SALINE WATER CONVERSION DEMONSTRATION PLANT NO. 1, FREEPORT, TEXAS.
Stearns-Roger Corporation, Denver, CO. Special Projects Division.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-189 422, Price codes: A11 in paper copy, A01 in microfiche. Research and Development Progress Report No. 171, April 1966. 191 p, 32 fig, 29 tab, 8 ref, 1 append. 14-01-001-218.

Descriptors: *Desalination plants, *Desalination processes, *Demonstration Plant No. 1, *Long-Tube Vertical distillation, *Desalination, Water purification, Mechanical equipment, Hydraulic machinery, Economics, Capital costs, Operating costs, Cost analysis, Cost comparisons, Evaluation, On-site investigations, Corrosion, Scaling, Construction materials, Evaporation.

A wide variety of information findings concerning the Long-Tube Vertical (LTV) multiple-effect evaporation method of desalination employed by Demonstration Plant No. 1, Freeport, Texas, is presented. Production, economy ratios, progressive costs averages, and maintenance problems are presented. The discussion of overall plant performance includes information on evaporator performance, heat rejection, deaeration, venting, and product water stabilization. Capital and operating costs are compared to theoretical 'normalized' capital and operating costs. A technical evaluation of the existing process, equipment, corrosion, and construction materials is included. The detailed process evaluation presents limitations of temperature and concentration ratios for scale-free operation of LTV evaporators without presoftening the feed water. Recommended plant modifications and proposed objectives of the development program are presented. A process flow diagram is included. (Davison-IPA)
W79-04953

REVERSE OSMOSIS MEMBRANE REGENERATION,
American Standard, Inc., New Brunswick, NJ.
E. A. G. Hamer, and R. L. Kalish.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-203 281, Price codes: A05 in paper copy, A01 in microfiche. Research and Development Progress Report No. 471, September 1969. 87 p, 8 fig, 22 tab, 16 ref, 1 append. 14-01-0001-1171.

Descriptors: *Membranes, *Reverse osmosis, *Cellulose acetate, *Cleaning, *Descaling, *Treatment, *Transport depletion, Membrane processes, Scaling, Feasibility studies, Ultrasonics, Chemical reactions, Compaction, Permeability, Desalination apparatus.

An investigation to determine the feasibility of extending the service life of cellulose acetate reverse osmosis membranes using surface cleaning and membrane regeneration procedures is discussed. The descaling experiments were performed on flat membranes coated with deposits of ferric oxide and calcium sulfate. The mechanical methods, ultrasonic vibration and sponge rubbing, were not effective beyond removing a superficial amount of the scale. Chemical removal was achieved with dilute solutions of 1 to 5% of sodium hydrosulfate and 0.2% oxalic acid at ambient temperature. Dilute solutions of hydrochloric and sulfamic were ineffective at ambient temperature. The sequestering agents were ineffective at ambient temperature, but the improved cleaning effect noted for citric and tartaric acids at 70C suggests that sequestation is a viable method at higher temperatures. The successful descaling reagents apparently do not damage the desalting properties of the membranes. Regeneration experiments were performed on flat virgin membranes subjected to accelerated compaction so that half their initial flux was lost. Membranes treated by heat soaking at temperatures close to those used in membrane preparation produced the best overall restored performance. (Davison-IPA)
W79-04954

RESEARCH CONTINUATION OF BADGER-HICKMAN CENTRIFUGAL DISTILLATION TESTING ON UNIT NUMBER 4.
Badger Co., Inc., Cambridge, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 390, Price codes: A05 in paper copy, A01 in microfiche. Research and Development Progress Report No. 15, March 1957. 74 p, 19 fig, 21 tab, 4 append. 14-01-001-81.

Descriptors: *Centrifugation, *Desalination, *Vapor compression distillation, Testing, Testing procedures, Evaluation, Measurement, Temperature, Condensers, Equipment, Desalination apparatus, Evaporation, Boilers, Corrosion, Scaling, Water treatment, Water purification, Sea water.

Group 3A—Saline Water Conversion

Experimental work testing the utility of a centrifugal phase barrier as the boiler-condenser unit of a vapor recompression still for producing water from sea water is reported. The experiments covered: (1) redetermination of some previously accumulated data; (2) measurements of factors to increase the total knowledge of the centrifugal method and to demonstrate the utility of larger size rotors; (3) the resistance to corrosion, scaling, and other functional failures through the use of higher temperatures for longer periods. During these tests the still was in productive operation for more than 1,000 hours with no major mechanical trouble. The endurance tests were conducted at 125F, 150F, and 180F, and it was determined that 150F is a practical temperature for the economic operation of this type of distillation unit. Data collected at this temperature results show relatively high heat transfer coefficients with no visual scaling at these low evaporation temperatures. It is concluded that the No. 4 Badger-Hickman still can operate for 200 hours, and possibly longer, on sea water without serious loss of efficiency at temperatures of 150F and below. The 4.5-ft diameter rotor has a steady state operating heat transfer coefficient 4 times the average present commercial vapor compression stills. The No. 4 still conformed to and extended the performance characteristics of the previous centrifugal phase barrier stills. (Davison-IPA)
W79-04955

3B. Water Yield Improvement

HARD-ROCK WELLS GET MARIPOSA THROUGH THE DROUGHT,
California Dept. of Water Resources, Sacramento.
A. Swanson.
Pacific Groundwater Digest, Vol. 2, No. 1, p 11-15, January 1979. 3 fig, 1 tab.

Descriptors: *Water supply, *Water wells, *Drilling, *Droughts, Aquifers, Crystalline rocks, Groundwater, Well spacing, Storage, *California.

During the 1976-77 drought in California the Mariposa Public Utilities Department inititated a well-drilling program to augment their surface-water supply. Mariposa is underlain by metamorphic and granitic rocks and wells drilled into these formations produce only small yields. Thirty wells were drilled with an air-rotary rig. The wells ranged in depth from 85 to 450 feet. Only six of the wells produced over 10 gpm and were pumped continuously. Seven were pumped intermittently, some a few hours a day, others only a few days a month. A 22-month well production curve shows the increase due to the new wells, their gradual depletion, an increase due to the first rainfall of the season, and another decrease due to taking wells out of service as the drought lessened. The number of hard-rock wells needed in a semiarid climate is controlled by the amount of ground water in storage around the wells, not the pumping rate of the individual wells. Also, well spacing should be great enough to minimize interference. The total production rate should exceed the anticipated water consumption rate by a factor of three. Also, wells would produce longer if pumped at a smaller percentage of their maximum yield. (Purdin-NWWA)
W79-04579

AN ANALYSIS OF DROUGHT RESEARCH NEEDS FOR COLORADO AGRICULTURE,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
W. A. Hall.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 064, Price codes: A04 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Colorado State University, Completion Report, September 1978. 67 p. OWRT A-038-COLO(1), 14-34-0001-8006.

Descriptors: *Drought, Water management, *Research priorities, *Soil conservation, *Soil-water-plant relationships, *Colorado.

An analysis was made of the research which must be accomplished in order to resolve drought related problems of Colorado, with particular emphasis on those problems relatively unique to Colorado. This work was based on the report 'Drought Research Needs' by Yevjevich, Hall and Salas (Nov. 1977), on consultations with Regional Directors and others of the Extension Service, the reactions of farmers in southeastern Colorado, and from personal experiences during nearly 25 years of research in agricultural water management practices and from a number of years spent in research policy related positions with the Federal government. This report further refines and identifies specific research requirements of Colorado using the Problem-Based Research Needs Analysis procedure developed earlier by the Federal Committee on Water Resources Research and Office of Water Research and Technology.
W79-04964

3C. Use Of Water Of Impaired Quality

ADVANCED STEPS TOWARDS THE POLLUTION-FREE BLEACHED SULFITE MILL,
IVL-Consulting Ltd., Goteborg (Sweden).
S. Bergkvist.
Svensk Papperstidning, Vol. 81, No. 13, p 423-425, September 25, 1978. 3 tab.

Descriptors: *Sulfite pulp mills, *Water pollution control, *Air pollution control, Wastes, Industrial wastes, Water pollution sources, Pulp wastes, Bleaching wastes, Pulp and paper industry, Sulfite liquors, Effluents, Capital costs, Costs, Burning, Pollution abatement, Bleached pulp mills, Spent sulfite liquor, Chemical recovery, Recovery furnaces, Washing(Pulp).

A survey has been conducted on possible methods for production of bleached sulfite pulps with minimum air and water pollution. For Mg-base sulfite mills environmental protection technologies have been adapted from Na-base mills. Dissolving-pulp mills can obtain a chlorine-free effluent suitable for joint chemical recovery with total mill effluents by introducing an NaOH extraction stage prior to bleaching. Considerable pollution reductions can be attained by oxygen bleaching of paper-grade sulfite pulps with NaOH as the base and including the oxygen stage in a closed washing cycle. Combustion of Na/Mg-base spent sulfite liquor can be performed in a conventional Mg recovery boiler with minor modifications, but the Na salts should be washed out from the MgO ash to avoid Na buildups in the mill system. All of the above-mentioned techniques were proven to be practicable in actual mill trials of several weeks duration. The capital expenditure for introducing Na into an existing Mg-base mill can be considerable, but will vary with the available equipment. When erecting a new Mg-base mill, however, the added investment for applying the Na/Mg technology should be low. (Brown-IPC)
W79-04639

MULTISOURCE/MULTIQUALITY AGRICULTURAL WATER USE DECISIONMAKING,
Office of Surface Mining Reclamation and Enforcement (DI), Washington, DC. Branch of Environmental Analysis.
M. A. Boster, and W. E. Martin.
Water Resources Bulletin, Vol. 15, No. 1, p 206-219, February 1979. 3 fig, 4 equ, 9 ref.

Descriptors: *Irrigation economics, *Water quality, *Conjuctive use, *Linear programming, *Computer models, *Irrigated farms, *Decision making, Irrigation water, Salinity, Agriculture, Imported water, Water resources, Projects, Regional analysis, Evaluation, Prices, Water policy, Equations, Effects, Optimization, Constraints, Systems analysis, Pinal County(Arizona), Yield reductions, Profit maximization.

The importation of water into an existing irrigated agricultural area raises many questions concerning farm profitability and suggests many adjustment alternatives open to farmers. In particular, how will farmers respond to a new additional water source of differing cost, availability, and quality. Linear programming computer models of representative irrigated farms in Pinal County, Arizona have been developed to project agricultural adjustments to new water from the Central Arizona Project now under construction. The models of farm enterprises in Pinal County maximize profits by maximizing net returns above variable production costs. Alternative courses of action available to the farmer include the different ways to produce a crop, the production of different levels of output for each crop, and the alternative crops which could be produced. The models reflect one crop season. The techniques developed have broad application to similar water resource projects involving the conjunctive use of multiple water sources of differing price and quality. Various management schemes can be evaluated by properly selected representative farm models. (Bell-Graf--Cornell)
W79-04693

3D. Conservation In Domestic and Municipal Use

WATER-CONSERVATION METHODS TO MEET PENNSYLVANIA'S WATER NEEDS,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
P. W. Fletcher, and W. E. Sharpe.
Journal of the American Water Works Association, Vol. 70, No. 4, p 200-203, April, 1978, 11 ref. OWRT-A-999-PA(5), 14-34-0001-8040.

Descriptors: *Water utilization, *Water conservation, *Septic tanks, *Domestic wastes, Water pressure, Water supply development, Consumptive use, Water supply, Sewerage, Infiltration, Waste water treatment, Waste water disposal, Municipal wastes.

Sources of potential water conservation in Pennsylvania are reviewed with respect to reducing the load on sewage treatment plants and residential waste water treatment sites. Water-saving devices attached to showerheads, toilets, and sinks can reduce water closet use to 3.5 gal/flush, compared to the conventional 4-6 gal, and shower water discharge to 3.5 gal/min, compared to the conventional 4-10 gal/min. Pressure-reducing valves can be installed to reduce residential water pressure to 340-410 kPa. Compressed air-assisted showers and water closets can reduce water consumption to 0.5 gal/min and 0.5 gal, respectively. Water saving devices can reduce sewage flows to the treatment plant by up to 7% and flows to residential on-lot disposal fields by 40%; infiltration-inflow comprises about 30-40% of the treatment plant influent, necessitating sewer line studies and corrections. Further water and energy saving techniques can be applied to dishwashers, clothes washers, and water heaters. (Lisk-FIRL)
W79-04598

ESTIMATION OF URBAN IRRIGATION WATER USE AND REQUIREMENT,
Hawaii Univ., Honolulu. Dept. of Civil Engineering.
Y-S. Fok, and E. T. Murabayashi.
Paper No. 78-2030, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah. 7 p, 7 ref. ASAE, St. Joseph, Michigan.

Descriptors: Water conservation, *Irrigation water, *Landscaping, Consumptive use, Water requirements, Aesthetics, Water utilization, *Lawns.

The difference between normal urban irrigation water use and the consumptive use requirement is the potential amount of water that might be saved without adverse economic consequences to urban property values. Methods for the estimation of urban irrigation water use and requirement are presented. (Skogerboe-Colorado State)
W79-04984

3E. Conservation In Industry

ADVANCED STEPS TOWARDS THE POLLUTION-FREE BLEACHED SULFITE MILL,
IVL-Consulting Ltd., Goteborg (Sweden).
For primary bibliographic entry see Field 3C.
W79-04639

UTILIZATION OF EVAPORATOR CONDENSATES AS A REPLACEMENT FOR FRESH WATER (ISPOL'ZOVANIE KONDENSATOR VYPARNOGO TSEKHA VZAMEN SVEZHEI VODY),
Sibirskii Nauchno-Issledovatelskii Inst. Tsellyulozy i Kartona (USSR).
For primary bibliographic entry see Field 5D.
W79-04646

3F. Conservation In Agriculture

USE OF METHANOL-WATER SOLUTIONS FOR FREEZE PROTECTION OF TENSIOMETERS,
Texas A and M Univ., Lubbock. Agricultural Research and Extension Center.
C. W. Wendt, O. C. Wilke, and L. L. New.
Agronomy Journal, Vol. 70, No. 5, p 890-891, September-October, 1978. 2 fig, 1 tab, 2 ref. OWRT C-7642(No. 7252)(1), 14-34-0001-7252.

Descriptors: Freezing, *Tensiometers, *Soil water, Soil water movement, Irrigation schedule.

The use of tensiometers to schedule irrigations has been limited primarily to summer crops because of water freezing in the tensiometers during the winter months. Since methanol-water mixtures have lower freezing points than water, a greenhouse study was conducted using an Olton loam soil (Acridic Paleustolls) to determine the effect of a methanol-water mixture (30% methanol by volume) on tensiometer readings and plant growth. No major effects of tensiometer readings or plant growth were noted. Results from a field demonstration on irrigated winter wheat (Triticum aestivum L.) indicate that tensiometers with such mixtures can be used to estimate soil water tension changes at atmospheric temperatures down to -18.8C. (Skogerboe-Colorado State)
W79-04605

THE EFFECT OF SALT PRECIPITATION AND HIGH SODIUM CONCENTRATIONS ON SOIL HYDRAULIC CONDUCTIVITY AND WATER RETENTION,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 2G.
W79-04650

NITROGEN SOURCES FOR HAY PRODUCTION ON FLOODED MEADOWS,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
A. E. Ludwick, C. B. Rumburg, and E. G. Siemer.
Soil Science Society of America Journal, Vol. 42, No. 3, p 509-512, May-June, 1978. 7 tab, 13 ref.

Descriptors: *Nitrogen compounds, Ammonium compounds, Fertilizers, Ureas, Nitrates, Denitrification, *Hay.

Three experiments were conducted over a 3-year period to compare various urea materials and ammonium nitrate as N sources for hay production on flooded meadow sites. Each experiment was a complete factorial combination of fertilizer N sources and rates broadcast once in the spring on established forage prior to flood irrigation. The N sources in these experiments consisted of ammonium nitrate, urea, sulfur-coated urea, urea ammonium polyphosphate and urea ammonium sulfate. Hay yields and N uptake were significantly increased by N fertilizer at each location; there was no significant response in hay yield or N uptake resulting from residual N in the second season of Experiment 1. Source of N did not influence hay yields nor N uptake. The N content of the hay was significantly influenced by the N fertilizer rate at two locations and the N source at one location. In general, hay yields and N uptake increased with increasing rates of fertilizer N. Fertilizer efficiency was low at all locations, ranging between 8.5 and 19.6 kg hay/kg N. Fertilizer N recovery was <30% for all treatments. Both efficiency and recovery of N tended to decrease with increasing N rates. (Kogerboe-Colorado State)
W79-04653

AGRICULTURE AND SALINITY,
For primary bibliographic entry see Field 5G.
W79-04659

EFFECTS OF AVAILABILITY OF WATER ON IRRIGATION SYSTEMS OPERATIONS,
Idaho Univ., Moscow.
J. R. Worstell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 714, Price codes: A06 in paper copy, A01 in microfiche. MS Thesis, October 1978. 90 p, 2 fig, 28 tab, 54 ref, 3 append. OWRT B-039-IDA(2). 14-34-0001-7152.

Descriptors: *Irrigation systems, *Irrigation efficiency, Droughts, Irrigation management, Conjunctive use.

An analysis was made of the effects of water shortage on two different irrigation systems. Irrigation diversion and delivery data were analysed. Estimates were made of consumptive use, of conveyance efficiencies. The analysis was made for different periods of time during the irrigation season and results reported for each time period for project irrigation efficiencies, unit irrigation efficiencies, and conveyance efficiencies. Comparisons of two rather unlike systems, one of which had been used to operating with shortages showed that during the 1977 drought year there was no marked change in the irrigation efficiencies for the irrigation districts studied. In the one case pumping of ground water was used as a means of supplementing supplies. This probably accounted for the tendency for irrigation efficiency to not change very markedly.
W79-04683

OPTIMAL IRRIGATION MANAGEMENT STRATEGY UNDER HYDROLOGIC AND IRRIGATION EFFICIENCY UNCERTAINTY REGIMES,
Idaho Univ., Moscow.
C. N. Udeh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 707, Price codes: A09 in paper copy, A01 in microfiche. PhD Dissertation, April 1978. 186 p, 30 fig, 33 tab, 201 ref, 2 append. OWRT B-039-IDA(1). 14-34-0001-7152.

Descriptors: *Irrigation efficiency, *Irrigation systems, *Mathematical models.

Optimization of the operation and management of an irrigation system is dependent on variability of the hydrologic phenomenon and variability in the various uncertainties involved in irrigation water use that are often lumped as irrigation efficiency. A Bayesian decision theory was developed to incorporate the uncertainties of hydrologic phenomenon and irrigation efficiency considering both time and space variation. Major inputs to the model included irrigation diversions, probabilistic irrigation efficiencies, three crop response functions, utility functions, irrigation production cost and crop price functions, consumptive use data and seasonal crop yield coefficients. The system modeled was an unimproved gravity irrigation system. The model was tested on an irrigation district located in Blaine County, Idaho. Results indicated that costs for irrigation water use and crop production costs as input functions were not as critical in influencing optimum results as the probabilistic hydrologic and irrigation efficiency parameters.
W79-04685

CHANGES IN BIOCHEMICAL CHARACTERISTICS OF CHERNOZEM SOILS IN THE REGION OF THE WESTERN SLOPE OF THE URAL MOUNTAINS DURING IRRIGATION,
Akademiya Nauk SSSR, Ufa. Inst. of Biology.
For primary bibliographic entry see Field 2G.
W79-04706

WATER ABSORPTION BY PLANTS IN A DRY WIND AND UNDER PERIODIC SPRAYING WITH WATER (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Inst. of Plant Physiology.
V. G. Egorov, G. V. Lebedev, V. Z. Dumbadze, and V. G. Bryukvin.
Fiziol Rast (Mosc) Vol. 24, No. 1, p 188-190, 1977.

Descriptors: Beans, *Humidity, Tea, Temperature, *Crop response, *Winds.

Bean and tea plants were subjected to a dry wind (43-45 degrees C, 25% humidity for beans and 36-37 degrees C, 30% humidity for tea at a rate of 3-4 m/s) while soil temperature and moisture level were held constant. Water absorption by plant root systems increased sharply under the effect of the wind, but decreased during periodic pulsed spraying of plants with water droplets. Thus this procedure may be used as a method for controlling the harmful effects of a dry wind on crops.--Copyright 1978, Biological Abstracts, Inc.
W79-04707

PHYSIOLOGICAL REACTION OF DIFFERENT CORN HYBRIDS TO DROUGHT (IN RUSSIAN),
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Kukuruzy, Dnepropetrovsk (USSR).
M. Ya. Tregubenko, G. L. Filippov, N. V. Vishnevskii, and L. A. Maksimova.
S-kh Biol Vol. 12, No. 3, p 412-418, 1977. English summary.

Descriptors: Photosynthesis, Respiration, Transpiration, *Drought resistance, *Crop response, *Corn, Plant physiology.

Water exchange, intensity of respiration and photosynthesis, resistance of plants of overheating and dehydration by the release of electrolytes from tissues of different corn hybrids were studied. Drought-resistant hybrids display high plasticity during drought. The decrease of the intensity of respiration and photosynthesis is less significant, the water-holding ability of leaves increases, and the release of electrolytes from tissues and the intensity of transpiration decreases.--Copyright 1978, Biological Abstracts, Inc.
W79-04708

CORN RESIDUE MANAGEMENT TO REDUCE EROSION IN IRRIGATION FURROWS,
Science and Education Administration, Prosser, WA. Agricultural Research.
For primary bibliographic entry see Field 4D.
W79-04724

POSSIBLE USE OF TRANSPIRATION WATER CONDENSATE OF SWEET POTATOES IN CULTIVATING PLANTS IN BIOLOGICAL LIFE SUPPORT SYSTEMS (IN RUSSIAN),
T. A. Derendyaeva.
Kosm Biol Aviakosm Med Vol. 10, No. 6, p 70-73, 1976. (English summary).

Descriptors: Transpiration, Biocontrol, Sweet potato, Crop response.

The effect of nonpurified condensate obtained during prolonged cultivation of batata (sweet potato, Impomoea batata) in a sealed chamber on batata cuttings and seedings of garden cress, radish and Chinese cabbage was studied. Nonpurified condensate produced an inhibitory effect on the formation of roots in batata cuttings and on the growth of previously developed roots of batata cuttings and seedlings. The studies, which used a chemical model of 3,4-dihydroxy phenylalanine in-

dicated that the condensate contained biologically active substances of organic origin. Only experiments with the real continuous culture of batata, using real dilutions of the condensate that depend on the size of the greenhouse and the amount of the nutrient solution, would clarify whether condensate of transpiration water of batata plants can be repeatedly utilized in life support systems (growing other agricultural plants under artificial conditions).
W79-04758

WATER BANKING: HOW TO STOP WASTING AGRICULTURAL WATER,
California Univ., Berkeley. Graduate School of Public Policy.
S. Angelides, and E. Bardach.
Institute for Contemporary Studies, San Francisco, CA, January 1978. 56 p, 1 fig, 92 ref.

Descriptors: *Water use, *Water resources planning, *Water law, *Water banking, *Water rights, *Water allocation(Policy), *Water consumption, Agriculture, Water resources development, Water resources, Economics, California, Legislation, Water transfer, Political constraints.

This study analyzes the history of agricultural water waste in California and proposes recommendations for policy change to effect wiser consumption of water resources. Past water policies have encouraged farmers to use water beyond their needs without paying increasing penalties for such waste. Agriculture consumes 85% of California's water; savings in agricultural water use would increase supply to the State's residential and industrial users. Existing water allocation systems, water rights law and water agency law have only encouraged waste by allowing use on a first come-first served basis rather than by the establishment of a priority system based upon type of use. A water transfer rights system is hampered by specific legal prohibitions and by procedures to protect 'third parties' to water use. The authors recommend a banking system--the purchase of water from some users by a water agency and its resale to other users--to be set up by each water agency. Such a system would expedite water transactions and act as an intermediary between sellers and buyers of water rights. The water banking proposal is described, benefits are presented, and the political prospects are discussed. Without effective political support of interested legislators and the State's water establishment, adoption of the water banking concept will be difficult, perhaps impossible. (Arnold-NC)
W79-04875

COMPUTER PROGRAMMING SOLID SET SYSTEMS,
Toro Co., Riverside, CA.
S. G. Griffin.
Paper No. 78-2012, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 9 p. ASAE, St. Joseph, Michigan.

Descriptors: *Sprinkler irrigation, Uniformity coefficient, *Computer programs, Water shortage, Simulation analysis, Nozzles, Design criteria, *Irrigation efficiency.

Solid set sprinkler system uniformity is of great importance in today's agriculture. A computer program for evaluating sprinkler performance has been developed. This program has shown to be valuable in product development as well as providing more accurate information on system operation to the grower in the field. (Skogerboe-Colorado State)
W79-04913

SIZING TAILWATER RECOVERY SYSTEMS TO UTILIZE RUNOFF FROM PRECIPITATION ON IRRIGATED LANDS,
Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.
H. L. Manges, and T. L. Mao.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 023, Price codes: A03 in paper copy, A01 in microfiche. Kansas Water Resources Research Institute, Kansas State University. Contribution No. 202, January 1979. 41 p, 4 fig, 8 tab, 16 ref. OWRT A-077-KAN(1), 14-34-0001-7035.

Descriptors: *Furrow irrigation, Deep percolation, *Irrigation efficiency, *Tailwater, Runoff, Precipitation, Groundwater.

A tailwater management model was developed to simulate runoff from precipitation, and to maintain a daily water budget on irrigated land and in the tailwater pit. Equations were developed to predict runoff from precipitation utilized for irrigation and pumping from ground water necessary for irrigated crop production. The model was run for the period 1949 to 1973 for furrow irrigated corn grown on two commonly irrigated soil types at Garden City and Larned, Kansas. About 25 percent of the runoff from precipitation can be utilized through proper management of normal size tailwater pits. Utilization of runoff from precipitation can be increased to about 70 percent by building tailwater pits five times their normal size. An economic analysis was made to determine the feasibility of building a larger than normal tailwater pit to utilize runoff from precipitation. At present energy prices, it is not economically feasible to build a larger tailwater pit to utilize runoff from precipitation. As the price of energy rises in the future, it may be economical to do so, especially when pumping from depths in excess of two hundred feed.
W79-04960

AN ANALYSIS OF DROUGHT RESEARCH NEEDS FOR COLORADO AGRICULTURE,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 3B.
W79-04964

ENVIRONMENTAL AND INSTITUTIONAL ASPECTS OF IRRIGATION AGRICULTURE,
Science and Education Administration, Riverside, CA. Salinity Lab.
J. van Schilfgaarde.
Paper No. 78-2045, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 6 p. 7 ref. ASAE, St. Joseph, Michigan.

Descriptors: Irrigation, Salinity, Drainage, *Institutional constraints, Environmental effects, Social aspects, *Irrigated land, Irrigation design.

Irrigation agriculture requires drainage, but design options and water management choices impact not only agricultural production. A host of institutional and societal considerations affect the viability of technically feasible alternatives. Drainage, as an integral part of water management, must be viewed within this larger framework and options identified that optimize total resource use. (Skogerboe-Colorado State)
W79-04978

MANAGEMENT FOR MINIMIZING NITROGEN LEACHING LOSSES ON IRRIGATED SANDY SOILS,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
D. Watts, D. Martin, P. Tscheschke, and M. England.
Paper No. 78-2025, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 22 p. 14 fig, 8 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Nutrient removal, Nitrogen, Nitrates, *Leaching, Organic matter, Nitrogen fixation, *Corn, Nebraska, Soil texture.

A model study was made to evaluate nitrogen uptake and the loss of water and nitrate from the root zone of irrigated corn on sandy soils in Western Nebraska. Three N sources, two N amounts and a wide range of irrigation applications were simulated for growing seasons with normal and 75 percent above normal rainfall. Control of irrigation amounts to minimize percolation and proper selection of nitrogen amount and source all had a significant effect on nitrate leaching loss. (Skogerboe-Colorado State)
W79-04980

PEACH TREE RESPONSE TO DRIP APPLICATION OF WATER AND NUTRIENTS,
Georgia Univ., Athens. Dept. of Agricultural Engineering.
J. L. Chesness, and G. A. Couvillon.
Paper No. 78-2019, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 19 p. 1 fig, 4 tab, 36 ref. ASAE, St. Joseph, Michigan.

Descriptors: Irrigation systems, Crop response, Crop production, *Peaches, Nutrient requirements, *Drip irrigation.

Two years of peach tree response to drip irrigation were reported on. Four treatments involving two water regimens and two water applied fertilizer rates were investigated. Yield in kg/cm trunk diameter/tree averaged 43 percent higher for the irrigated treatments. There was no significant difference in the yield and elemental leaf tissue levels for trees receiving one-half levels of nutrients applied through the system. (Skogerboe-Colorado State)
W79-04981

CONTOUR FURROW IRRIGATION WITH LIQUID MANURE USING 'MICROTUBING' FOR FLOW CONTROL,
Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
W. R. DeTar.
Paper No. 78-2027, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 45 p. 15 fig, 9 tab, 4 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Contour furrows, *Furrow irrigation, Fertilizers, Liquid wastes, Flow control, Irrigation systems.

The trickle-furrow concept is introduced. The low infiltration rate of dilute liquid manure makes possible 100 ft lengths of run with only 0.3 gpm/furrow. Furrows can run 8 hrs/set. Proposed is a solid-set arrangement of 1000 ft of corrugated plastic tubing laterals descending 5-10% slopes with microtubing outlets at each furrow. Field experiment yields rate-of-advance curves. A prediction equation is given for length of run. Friction loss data are presented. Work is still in progress. (Skogerboe-Colorado State)
W79-04982

ASSESSING TRICKLE EMITTER APPLICATION UNIFORMITY,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
F. S. Nakayama, D. A. Bucks, and A. J. Clemmens.
Paper No. 78-2017, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978. Logan, Utah, 7 p, 6 fig, 2 tab, 4 ref, 2 append. ASAE, St. Joseph, Michigan.

Descriptors: Irrigation systems, Uniformity coefficient, Water conservation, Application methods, *Irrigation efficiency, *Sprinkler irrigation, Statistical methods, Flow rates, Frequency curves.

A method was developed for showing the uniformity of water application by trickle emitters based on the emitter's coefficient of variation. The derived design uniformity coefficient equation for different numbers of emitters per plant was related to the uniformity coefficient used in sprinkler irrigation. The interrelationship between the computed design uniformity coefficient, the manufacturer's coefficient of variation for the emitter, and the

number of emitters per plant can be used as a guide for selecting the number of emitters per plant. In addition, a field uniformity coefficient and a field emitter coefficient of variation were related to the fraction of plants adequately irrigated. (Skogerboe-Colorado State)
W79-04990

DRIP IRRIGATION OF ORANGE TREES IN HUMID CLIMATE,
Florida Univ., Gainesville. Dept. of Agricultural Engineering.
J. M. Myers, and D. S. Harrison.
Paper No. 78-2018, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 7 p, 8 tab, 8 ref. ASAE St. Joseph, Michigan.

Descriptors: *Sprinkler irrigation, Irrigation systems, *Oranges, Humid climates, Citrus fruits, Crop production, Statistical methods, Florida, *Drip irrigation.

Results of a four-year study of drip and overhead sprinkler irrigation on orange trees grown in Florida on a sandy soil indicate responses are highly dependent on rainfall amounts and characteristics. For a year with rainfall 28% below normal average yields from trees with 2, 4 and 6 emitters/tree were 4.00,4.24 and 4.83 boxes/tree, respectively. Yields for sprinkler and no irrigation checks were 4.41 and 2.37 boxes/tree. Differences in yield between the three drip irrigation treatments and the sprinkler check were not significant at the 95% confidence level, however, all four of these treatments were significantly better than the no irrigation check. Average yields for quantities of water for drip irrigation were 4.13, 5.16 and 5.43 boxes/tree for low, medium and high amounts, respectively. The statistical significance of the water quantity results are identical to those for the emitter density results. Supplemental fertilizer application, through the drip water distribution system, of 19-0-19 k/ha/year and 38-0-38 k/ha/year of N-P-K did not appear to influence yields of oranges. Irrigation treatments did not significantly affect production in years with average or above average treatment or rainfall. (Skogerboe-Colorado-State)
W79-04991

ECONOMIC ANALYSES OF MULTIPLE PIVOT IRRIGATON ON A DROUGHTY SOIL,
Minnesota Univ., Minneapolis. Dept. of Agricultural Engineering.
M. A. Otterby, and D. W. DeBoer.
Paper No. 77-2006 presented at the 1977 Annual Meeting of the American Society of Agricultural Engineers, June 26-29, 1977, Raleigh, North Carolina. 18p, 4 fig, 6 tab, 8 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Sprinkler irrigation, Crop production, Corn, Alfalfa, Soils, *Irrigaton practices.

Economic analyses consisting of annual costs and returns were used to compare the profitability of using one center pivot irrigation machine on more than one field. Corn and alfalfa yields from an associated field study were used as a basis for the analyses. For corn, one center pivot machine used to irrigate one corn field gave the highest return to land and management. For alfalfa, one center pivot machine for two fields gave the highest return. (Skogerboe-Colorado State)
W79-04995

MINIMIZING SALT IN RETURN FLOW THROUGH IRRIGATION MANAGEMENT.
Agricultural Research Service, Riverside, CA. Salinity Lab.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 637, Price codes: A07 in paper copy, A01 in microfiche. Report EPA-600/2-77-134, July, 1977. 111 p, 43 fig, 37 tab, 23 ref, 2 append.

Descriptors: Arizona, Salts, *Irrigation effects, *Return flow, *Leaching, Alfalfa, Surface irrigation.

Two field experiments are being conducted in southwestern Arizona to investigate the potential of reducing the salt load in irrigation return flow by decreased leaching. Three leaching treatments of 5, 10, and 20 percent, replicated nine times for citrus and five times for alfalfa, were established and compared with conventional flood irrigation management. (Skogerboe-Colorado State)
W79-04996

POTATO AND LETTUCE RESPONSE TO IRRIGATION METHODS AND PRACTICES,
New Mexico State Univ., Las Cruces.
T. W. Sammis, and E. G. Hanson.
Paper No. 78-2020, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah. 11 p, 2 fig, 7 tab, 9 ref. ASAE, St. Joseph, Michigan.

Descriptors: Irrigation practices, Irrigation systems, Surface irrigation, Subsurface irrigation, Sprinkler irrigaton, *Potatoes, *Lettuce, *Irrigation efficiency, Crop response, Crop production.

Spring potatoes and fall lettuce were irrigated with sprinkler, trickle, subsurface, and furrow irrigations for two consecutive years. Results are presented that pertain to the influence of these methods on crop yield, water-use efficiency, quality at maturity, and the variability of measurements. The lowest irrigation ratio for two consecutive years was achieved by trickle and subsurface irrigation. Water-use efficiency was indeterminate for the 1975 lettuce cropping year. In 1976, subsurface irrigation of lettuce resulted in the highest water-use efficiency. Subsurface and trickle irrigation of potatoes resulted in the highest water-use efficiency in 1975, and by subsurface irrigation of potatoes resulted in the highest water-use efficiency in 1976. (Skogerboe-Colorado State)
W79-04997

QUANTIFICATION OF RICE YIELD BENEFITS ATTRIBUTABLE TO IRRIGATION WATER,
International Rice Research Inst., Los Banos, Laguna (Philippines). Dept. of Irrigation and Water Management.
S. I. Bhuiyan, and A. Sumayao.
Paper No. 78-2022, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah. 12 p, 15 fig, 1 tab, 16 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Rice, *Irrigation, Moisture stress, Crop response, Crop production, Yield equations, Regression analysis, Irrigation effects.

An experiment with a split-plot design was conducted at three different locations to grown LR-36 variety of rice in the dry season when no crop can be grown without irrigation water in order to quantify rice yield benefits due to irrigation under farmers' field condition. Five irrigation treatments, representing various degrees of water stress during the reproductive growth stage of the crop, were imposed in the main plots and three management package treatments, representing the average farmer's level, intermediate level and high level use of other inputs, were imposed in the subplots. High level of management combined with adequate water produced about 5.1 t/ha, whereas farmer level management under adequate water yielded 2.9 t/ha. Yield was reduced consistently as stress days increased. An average of thirty-one stress days caused a yield reduction of 1.0 t/ha under the farmer level management, but an average reduction of about 1.5 t/ha under the two higher level managements. A regression model developed showed that the location of the experiment had no significant effect on the yield. The model predicts yield variation due to stress days and levels of managment. Management was found to have a much stronger influence on yield than water stress. (Skogerboe-Colorado State)
W79-04999

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

BROWNS FERRY BIOTHERMAL RESEARCH SERIES. I. COLONIZATION BY PERIPHYTON, ZOOPLANKTON, AND MACROINVERTEBRATES,
Tennessee Valley Authority, Decatur, AL. Div. of Forestry, Fisheries and Wildlife Development.
For primary bibliographic entry see Field 5C.
W79-04533

LOSS OF HIGH FLOWS BY SEEPAGE FROM STREAM CHANNELS IN KANSAS,
P. R. Jordan.
Kansas Water News, Vol. 21, Nos. 1 & 2, p 30-40, 1978. 3 fig, 2 ref.

Descriptors: *Seepage, *Water loss, *Subsurface runoff, Surface-groundwater relationships, Runoff, Hydrologic data, Groundwater recharge, Soil moisture, Bank storage, Influent streams, Gaging stations, *Kansas.

Seepage loss during high flow in Kansas streams contributes to ground-water recharge, soil-moisture storage and bank storage. A small amount is lost by evaporation. Hydrologic modeling of aquifer-stream dynamics requires data on seepage loss. This report discusses general relationships that can be used for estimating seepage losses for high flow when direct data are not available. Seepage loss data are obtained by measuring the difference in stream flow at two consecutive gaging stations. It is expressed as a percent of the flow volume at the upper station. The average seepage loss per square mile was plotted against flow at upper station for diminishing streams and streams in western and central Kansas. The variation between streams is less than the variation between different events on the same stream. Diminishing streams have the highest average seepage losses from 2.7 to 5.8 percent per mile. Seepage loss for medium to large streams in western Kansas averages 1.3% per mile. For central seepage losses tend to be smaller than those in western Kansas. In eastern Kansas, seepage losses of storm run off are rare or non-existent. (Purdin-NWWA)
W79-04577

HYDROLOGIC IMPACT OF GRAZING SYSTEMS ON INFILTRATION AND RUNOFF: DEVELOPMENT OF A MODEL,
Utah State Univ., Logan. Coll. of Natural Resources.
For primary bibliographic entry see Field 2A.
W79-04585

A NONLINEAR ANALYSIS OF THE RELATIONSHIP BETWEEN RAINFALL AND RUNOFF FOR EXTREME FLOODS,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2A.
W79-04604

CHARACTERIZATION OF THE GROWTH OF MYRIOPHYLLUM SPICATUM AND ITS INFLUENCE IN THE AQUATIC ECOSYSTEMS OF THE TENNESSEE VALLEY,
Tennessee Univ., Knoxville.
C. C. Amundsen, and A. L. Brenkert.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 696, Price codes: A05 in paper copy, A01 in microfiche. Tennessee Water Resources Research Center, University of Tennessee, Research Report No. 67, December 1978. 86 p, 242 ref. OWRT B-037-TENN(1). 14-34-0001-8119.

Descriptors: *Aquatic weeds, Aquatic weed control, Myriophyllum spicatum, Rooted aquatic plants, Eurasian water milfoil, Macrophytes.

The literature concerning Eurasian watermilfoil (Myriophyllum spacatum L.) is reviewed. The purpose is to understand more clearly which factors in an aquatic ecosystem may have a determining influence on whether a species of aquatic macrophyte becomes an aggressive weed. Consideration of the taxonomy and genetics of watermilfoil provides no conclusive evidence for the claim that Myriophyllum spicatum L. is an introduced species. The growth form of Eurasian watermilfoil allows it to out-compete any other aquatic macrophyte. The mass of long leafless stems with the dense canopy of branches at the top layer of the water column easily moving up and down with any water level fluctuation does not give other aquatic macrophytes a chance to coexist in the same space. Moreover the extensive rhizome system and the delayed senescence of the vegetative mass makes it possble for milfoil stands to hold their place from year to year. Water drawdown in reservoirs only increases the spread of milfoil, for new shoots will form at the edge of the stands at bed depths where previously little light penetrated. The abscission of the lateral branches at certain times of the year and the immediate formation of adventitious roots enables the weed to spread to new areas.
W79-04625

INSTITUTIONAL CONCERNS: THE DELAWARE EXPERIENCE.
Geological Survey, Milford, PA. Water Resources Div.; and Geological Survey, Reston, VA. Water Resources Div.
R. E. Fish, and F. T. Schaefer.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of the Water Resources Planning and Management Irrigation and Drainage Divisions, Virginia Polytechnic Institute, Blacksburg, Virginia, July 26-28, 1978. 15 p, 4 fig, 9 ref.

Descriptors: *Delaware River Basin Commission, *Interstate commissions, *Water management(Applied), *Regulation, *Reviews, Institutions, Water supply, Water distribution(Applied), Diversion, Administration, Delaware, Maryland, New Jersey, New York.

Attempts to negotiate interstate compacts for utilizing Delaware River water began in 1925. These negotiations failed. The State and city of New York then proceeded with plans for storage and diversion. The plans were opposed by New Jersey, which sought relief before the Supreme Court of the United States. Pennsylvania intervened, and a decree apportioning the waters was handed down in 1931. The matter was reopened in 1952, with Delaware also intervening, and an amended decree was entered in 1954, setting forth diversion limitations and in-stream flow requirements and establishing a River Master to oversee compliance. In 1961 a Federal-interstate compact was adopted, and the Delaware River Basin Commission came into existence. The Commission was granted broad powers but was enjoined from interfering with operations under the amended decree except under conditions of drought or catastrophe. (Woodard-USGS)
W79-04804

FLOOD PLAIN INFORMATION: BIG THOMPSON RIVER, WELD COUNTY, COLORADO,
Army Engineer District, Omaha, NE.
For primary bibliographic entry see Field 2E.
W79-04854

FLOOD PLAIN INFORMATION: TCHEFUNCTA RIVER AND TRIBUTARIES, COVINGTON, LA.
Army Engineer District, New Orleans, LA.
For primary bibliographic entry see Field 2E.
W79-04855

THE RIVER'S REACH: A UNIFIED PROGRAM FOR FLOOD PLAIN MANAGEMENT IN THE CONNECTICUT RIVER BASIN.
New England River Basins Commission, Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 079, Price codes: A15 in paper copy, A01 in microfiche. December 1976. 292 p, 33 fig, 42 tab, 7 appendices.

Descriptors: *Rivers, *River beds, *Floodways, *Flood plains, *Flood plain insurance, Warning systems, *New England, *Connecticut River, *Flood plain management, Floods, Flooding, Historic Floods, Flood data, Flood damage, *Flood protection, Flood plain zoning, Building codes, Land use, Planning, Zoning, Control structures, Dikes, Dams, Reservoirs, Water storage, Floodproofing, Water quality, Cost-benefit analysis, Environmental effects, Connecticut, New Hampshire, Vermont, Massachusetts, Recreation, Fish and Wildlife, Governments, Coordination.

This report was written to help communities in 4 New England states reduce over $15 million in average annual flood damages. The major objectives of the study are: to prevent loss of life; to effect wise choice among competing uses of flood plains; to reduce the potential for damage for existing development in flood hazard areas; and to prevent damages from increasing. Floods in the Connecticut River Basin are caused by rainfall and snowmelt. Two severe floods occurred in 1936 and 1938; since that time flood control structures have been constructed. In spite of these preventive measures, with increasing urbanization flood damage losses are increasing. Two strategiescan be used to reduce flood damages; a flood reduction strategy and an implementation strategy. Major flood projects of 6 cities are analyzed. The flood modification alternatives of reservoirs, dike raising, and non-structural approaches are examined and all three recommended in various drainage basins of the area. A cost-benefit analysis is presented and environmental and water quality impacts for recreation, fish and wildlife, and historic sites are discussed for the individual reservoirs. Local structural options are presented for 3 of the watersheds. A detailed discussion on how to modify susceptibility to flooding includes discussions on nonstructural options, with conclusions and recommendations included for each method. Coordination, communication, and cost sharing are discussed with recommendations for government and local agency coordination, federal financial support, cost-sharing agreements and unified program agreement between the four states. An environmental impact statement for the Unified Program is presented as one of the appendices. (Arnold-NC)
W79-04857

FLOOD HAZARD ANALYSES: WASHITA RIVER, RAINY MOUNTAIN CREEK, MOUNTAIN VIEW AND VICINITY, KIOWA COUNTY, OK.
Soil Conservation Service, Stillwater, OK.
For primary bibliographic entry see Field 2E.
W79-04860

FLOOD PLAIN INFORMATION: CALCASIEU RIVER, OAKDALE, LOUISIANA,
Army Engineer District, New Orleans, LA.
For primary bibliographic entry see Field 2E.
W79-04861

FLOOD HAZARD STUDY: BARK RIVER, VILLAGE OF DOUSMAN AND VICINITY, WAUKESHA COUNTY, WISCONSIN.
Soil Conservation Service, Madison, WI.
For primary bibliographic entry see Field 2E.
W79-04863

SPECIAL FLOOD HAZARD INFORMATION: FRANKLIN, LOUISIANA AND VICINITY, YOKELY BAYOU AND BAYOU TECHE.
Army Engineer District, New Orleans, LA.
For primary bibliographic entry see Field 2E.
W79-04864

FLOOD PLAIN INFORMATION: SALT CREEK - VICINITY OF PUEBLO, COLORADO.
Army Engineer District, Albuquerque, NM.
For primary bibliographic entry see Field 2E.
W79-04865

FLOOD HAZARD ANALYSES: MCKENZIE RIVER, HEDRICKS BRIDGE TO LEABURG DAM, LANE COUNTY, OREGON.
Soil Conservation Service, Portland, OR.
For primary bibliographic entry see Field 2E.
W79-04866

PLANNING STATUS REPORT: WATER RESOURCE APPRAISALS FOR HYDROELECTRIC LICENSING--LOWER WHITE RIVER BASIN, MISSOURI-ARKANSAS.
Federal Energy Regulatory Commission, Washington, DC. Bureau of Power.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 009, Price codes: A02 in paper copy, A01 in microfiche. Originally issued 1965, revised 1977. 16 p, 2 fig, 5 tab.

Descriptors: *Water resources planning, *Reservoirs, *Water quantity management, *Hydroelectric power, *Hydroelectric project licensing, *Water resources management, *White River Basin(MO & AR), *Lower White River Basin(MO & AR), River basins, Flood control, Groundwater, Thermal power, Electric powerplants.

This report is one of a series of revised Planning Status Reports for major river basins in the U.S. The purpose of the reports is to provide up-to-date information on water resources for use by the Federal Power Commission, and they present data on existing and potential water resource developments and on water use by existing and projected thermal generating facilities. This report covers the Lower White River Basin of Southeastern Missouri and East Central Arkansas. The basin, a drainage area of 17,893 square miles, contains three hydroelectric-flood control structures with a combined installed capacity of 532,000 kilowatts, and four fossil fueled steam electric plants with a total generating capacity of 1,390,000 kilowatts. Potential water resource developments in the Basin include six conventional reservoirs with a combined storage capacity of 327,000 kilowatts and four pumped storage projects with a combined storage capacity of 4,300,000 kilowatts. Five flood control reservoirs projected to store a capacity of 2,180,000 area feet of water are planned. Estimated generating capacities from steam electric plants are projected to be 1,390,000 kilowatts (for 1985) and 4,724,000 kilowatts (for 2000). Proposed further studies for land and water resource uses should include fish and wildlife enhancement irrigation and drainage, forest conservation, soil and water conservation, recreation, and increased navigation and flood control. (Arnold-NC)
W79-04872

PLANNING STATUS REPORT: WATER RESOURCE APPRAISALS FOR HYDROELECTRIC LICENSING--UPPER WHITE RIVER BASIN, MISSOURI AND ARKANSAS.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 010, Price codes: A02 in paper copy, A01 in microfiche. Originally issued 1965; revised 1977. 13 p, 2 fig, 3 tab.

Descriptors: *Water resources planning, *Reservoirs, *Water quantity management, *Hydroelectric power, *Hydroelectric project licensing, *Water resources development, *White River Basin (MO & AR), *Upper White River Basin(MO & AR), River basins, Flood control, Groundwater, Thermal power, Electric powerplants.

This report is one of a series of revised Planning Status Reports for major river basins in the U.S. The purpose of the report is to provide up-to-date information on water resources for use by the Federal Power Commission, and they present data on existing and potential water resource develop-

ments, and on water use by existing and projected thermal generating facilities. This report covers the Upper White River Basin of the Southwestern Missouri and Northwestern Arkansas Ozark Region. The basin, a drainage area of 9,872 square miles, contains five hydroelectric flood control structures with a combined installed generating capacity of 738,000 kilowatts. Potential water resource developments include six hydroelectric projects with a planned installed generating capacity of 341,000 kilowatts; planned generating capicity for steam electric plants in the Basin is projected at 707,000 kilowatts for 1985 and 7,157,000 kilowatts for the year 2000, including proposed nuclear capacity of 6,000,000 kilowatts, using dry towers for cooling. The Corps of Engineers has been studying the advisability of providing additional measures for flood control, regional and agricultural water supply, hydroelectric power, recreation, fish and wildlife and other related water and land resources. (Arnold-NC)
W79-04873

FLAT CHANNEL TERRACES FOR POLLUTION ABATEMENT AND SEDIMENT CONTROL,
Soil Conservation Service, Grand Island, NE.
H. G. Buchta, W. W. Liesemeyer, and L. G. Jackson.
Paper No. 78-2521, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Palmer House Hotel, Chicago, Illinois, 5 p. 1 fig, 4 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Terracing, Pollution abatement, *Sediment control, Runoff, Crop production, Semiarid climates, Computer programs, Diversion, Gullies, Nebraska.

Flat channel terraces have been effectively used to control and use runoff water. The runoff can help stabilize crop production in a semiarid climate. Parallel flat channel terraces are growing in popularity. (Skogerboe-Colorado State)
W79-04914

PARALLEL TERRACES ON FLAT SLOPES,
Agricultural Research Service, Big Spring, TX.
D. W. Fryrear, and E. Archer.
Paper No. 78-2522, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Palmer House Hotel, Chicago, Illinois, 15 p, 2 fig, 1 tab, 8 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Terracing, Slopes, *Slope stabilization, Soil conservation, Water conservation, Crop production, Dry farming, Texas, Runoff.

West Texas has more terraces constructed each year than most states. This manuscript describes the design, layout, and construction of parallel terracing systems in this part of the state. Several farmers were interviewed concerning their feelings about parallel terraces and why they are used on their farms. The farmers are enthusiastic with the benefits of terraces particularly if they are involved in the design and construction of the system. Despite the point rows, more skilled operators, and increased time in the field, some producers feel that the increased production from terraced fields will pay for the construction costs in four to five years. (Skogerboe-Colorado State)
W79-04915

INTERCEPTOR DRAINS ON SLOPING LAND,
Washington State Univ., Pullman. Dept. of Agricultural Engineering.
R. Gharaaty-Sani, and L. G. King.
Paper No. 78-2038, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 21 p. 11 fig, 2 tab, 21 ref. ASAE, St. Joseph, Michigan.

Descriptors: Subsurface drains, *Subsurface drainage, Interception, Canal seepage, Steady flow, Numerical analysis, Seepage, Flow rates, Water table.

A single subsurface drain intercepting seepage from an upslope source such as a canal was studied under steady flow conditions. Numerical methods were used to solve the nonlinear partial differential equation describing the two-dimensional problem with both partially and fully saturated flow occurring. Three different soils and three different depths of water in the canal were studied using this model. The resulting water table and drain discharge were compared with published theory based upon laboratory flume studies which neglected or minimized partially saturated flow. The published theory predicts water table shape and location adequately for design purposes; however, the drain discharge given by such theory is low (sometimes for fine textured soils, as low as fifty percent of that given by this study). Neglecting partially saturated flow could lead to undersized drains on sloping lands. (Skogerboe-Colorado State)
W79-04916

DEPOSITION OF NONUNIFORM SEDIMENT ON CONCAVE SLOPES,
Purdue Univ., Lagayette, IN. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2J.
W79-04917

WALNUT CREEK CHANNEL IMPROVEMENT PROJECT, CONTRA COSTA COUNTY, CALIFORNIA; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 2E.
W79-04923

PROCEEDINGS, RESEARCH PLANNING CONFERENCE ON THE AQUATIC PLANT CONTROL PROGRAM, 3-7 OCTOBER 1977.
Army Engineer Waterways Experiment Station, Vicksburg, MS.
Miscellaneous Paper A-78-1, August 1978. 267 p, 1 append.

Descriptors: *Aquatic weed control, *Aquatic plants, *Planning, Conferences.

The 12th Annual Meeting on the U.S. Army Corps of Engineers Aquatic Plant Control Research Program was held in New Orleans, La., on 3-7 October 1977 to review current operations activities and to afford an opportunity for presentation of current research projects. (WES)
W79-04932

MINIMIZING SALT IN RETURN FLOW THROUGH IRRIGATION MANAGEMENT.
Agricultural Research Service, Riverside, CA. Salinity Lab.
For primary bibliographic entry see Field 3F.
W79-04996

4B. Groundwater Management

ANALYTICAL STUDY OF THE OGALLALA AQUIFER IN DAWSON AND BORDEN COUNTIES, TEXAS, PROJECTIONS OF SATURATED THICKNESS, VOLUME OF WATER IN STORAGE, PUMPAGE RATES, PUMPING LIFTS, AND WELL YIELDS,
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 7C.
W79-04576

MANAGING THE LOW-YIELD WATER WELL,
Hydrodyne Development Co., Forestville, CA.
M. Fisher.
Pacific Groundwater Digest, Vol. 2, No. 1, p 21-28, January, 1979. 1 fig.

Descriptors: *Water supply, *Water wells, *Water management, *Water yield, Water utilization, Pumping, Control systems.

The problems of low-yield wells in relatively impermeable aquifer material can be managed with periodic service maintenance. It is possible to design a reliable system that will make a one-half gpm well into a 720 gpd water supply which will be more than adequate for domestic water uses. The installation and maintenance of water systems with low-yield wells requires skilled and experienced mechanics. A pump can be prevented from running dry or gulping air with a control which integrates an air line, a direct-acting sensitive pressure-responsive switch and a small electric air pump. This control keeps the pump off till the well has recovered 6 feet. For wells that may not have even a 6 foot total recovery a different control is available which can be adjusted to work at differentials of from 4 inches to 18 inches. The air line can be disconnected from the control and used to feed water conditioning chemicals into the well. The design and operation of a water system with very low-yield wells is described in some detail along with a diagram showing the key components of the system. (Purdin-NWWA)
W79-04580

FIELD EVALUATIONS OF GROUNDWATER CONTROL BY TRENCH AND TRENCHLESS METHODS OF INSTALLED DRAINS--LOWER RIO GRANDE VALLEY OF TEXAS,
Soil Conservation Service, Temple, TX.
G. C. Vittetoe, and B. J. Garner.
Paper No. 78-2043, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 6 p. 7 fig. ASAE, St. Joseph, Michigan.

Descriptors: *Subsurface drainage, Subsurface drains, Drainage practices, Trenches, Salinity, Flow rates, Water quality control, Texas, Groundwater management.

Results are presented of field evaluations of the flow performance of 209 subsurface drainage systems in the Lower Rio Grande Valley of Texas. These drain systems are installed to control groundwater and serve as artificial subsurface drainage arteries for salinity management in an irrigated area. Of the 209 examined installations, 141 were installed by the trench method and 68 by the trenchless method. All systems were installed in calendar years 1975 and 1976, and all utilized perforated corrugated plastic tubing, of 4- to 6-inch diameter size, and nylon fabric filters. The evaluations reveal the ability of the 209 drain systems to discharge flow in the presence of a groundwater flow source, with the surface of the groundwater variously ranging from 2 to 6 feet below the ground surface. The data displays a strong general disparity in the unit flow for systems installed by the trench and trenchless methods, with the trench method showing a noticeably higher flow performance for seemingly similar conditions. In repeated instances, the flow performances of systems installed by the trenchless method were less than that believed to be needed to satisfy minimal drainage coefficients for the area. (Skogerboe-Colorado State)
W79-04906

PRELIMINARY ASSESSMENT OF POLICY AND MANAGEMENT OPTIONS FOR GROUNDWATER MINING IN THE GREAT PLAINS,
Kansas Water Resources Research Inst., Manhattan.
F. Keller, G. Heatwole, and J. Weber.
Availabie from the National Technical Information Service, Springfield, VA 22161 as PB-292-969, Price codes: A10 in paper copy, A01 in microfiche. Contribution No. 204, February 1979. 106 p, 23 fig, 41 tab, 95 ref, append. OWRT B-046-KAN (2), 14-34-0001-6080.

Descriptors: *Groundwater mining, Kansas, Colorado, Nebraska, Aquifer Management, Groundwater management, Policy, Decision making, Ogallala aquifer.

This project examined the viability of groundwater management districts in those parts of the high

plains experiencing groundwater mining. Specifically the project focused on the states of Kansas, Colorado and Nebraska, especially the portions underlain by the Ogallala Aquifer. The districts were studied through field research and a mail survey utilizing a thirteen page questionnaire. The field research was conducted in four states and districts were surveyed in five states. Analysis of the data indicated districts were willing to implement policies such as well spacing and metering but that any regulation beyond these policies will be at best not opposed.
W79-04957

MATHEMATICAL METHODS FOR ANALYSIS OF FRESH WATER LENSES IN THE COASTAL ZONES OF THE FLORIDAN AQUIFER,
Florida Univ., Gainesville. Water Resources Research Center.
B. A. Christensen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 067, Price codes: A09 in paper copy, A01 in microfiche. Publication No. 44, 1978. 171 p, 53 fig, 1 tab, 68 ref, 5 append. OWRT A-032-FLA(1), 14-34-0001-8010.

Descriptors: *Groundwater, *Aquifers, Florida, *Artificial recharge, Numerical model, Model studies, *Sea water intrusion, Water table, Injection wells.

Concentrated land development in Florida's coastal regions often leads to saltwater intrusion in coastal aquifers. It has been proposed that excess freshwater could be artificially recharged to these coastal aquifers in order to drive out the intruded saltwater by the formation of a freshwater lens. The purpose of this study is to develop methods for analyzing this process. A numerical model based on the finite element method is developed by which the boundaries of a growing freshwater lens can be traced in two horizontal dimensions. This model simulates the injection of freshwater through multiple wells into a thin confined or leaky saline aquifer in which there may be a pre-existing head gradient. The use of the model is demonstrated by application to the peninsula of Pinella County, Florida. A case study concerning a South Florida retirement community illustrates the hydrologic analysis of developed land constructed by dredging and filling. Field data was collected, interpreted and used in a numerical model which simulates interaction between the dredged canals and the water table in the reclaimed land. Finally, a numerical scheme using the method of characteristics is developed to predict the movement in the vertical plane of the interface at the boundary of a freshwater lens in a saline aquifer. (Heaney-Fla)
W79-04961

SUBSURFACE DRAIN SPACING FROM WATER TABLE AND OUTFLOW MEASUREMENTS,
Ohio Agricultural Research and Development Center, Columbus. Dept. of Agricultural Engineering.
D. W. Michener, G. O. Schwab, R. W. Skaggs, J. D. Gordos, and C. J. Olosky.
Paper No. 78-2536, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois, 12 p. 2 fig, 8 tab, 6 ref. ASAE, St. Joseph, Michigan.

Descriptors: Subsurface drains, *Subsurface drainage, Water table, Drawdown, Hydraulic conductivity, Porosity, Discharge measurement, Soil texture, Statistical methods.

Hydraulic conductivity and drainable porosity were determined from water table drawdown and outflow measurements for six fine-textured soils in Ohio. Drain spacings were computed for three drawdown rates with a coefficient of variation of about 30%. When drawdown was corrected for evapotranspiration, spacings were reduced about 16%. (Skogerboe-Colorado State)
W79-04986

ANALYSIS OF COMBINATION SURFACE-SUBSURFACE DRAINAGE SYSTEMS FOR HUMID REGION SOILS,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
R. W. Skaggs.
Paper No. 78-2541, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois. 16 p, 13 fig, 5 tab, 20 ref. ASAE, St. Joseph, Michigan.

Descriptors: Surface drainage, Subsurface drainage, *Drainage systems, Simulation analysis, Trafficability, Humid climates, Model studies, Crop production.

Various designs of combination surface-subsurface drainage systems were analyzed by simulating their performance over twenty-five years of climatological record. Simulations were conducted and results analyzed for 4 soils at 3 locations: Jacksonville, Florida, Wilmington, North Carolina, and Columbus, Ohio. (Skogerboe-Colorado State)
W79-04989

INCORPORATING CROP NEEDS INTO DRAINAGE SYSTEM DESIGN,
Castle and Cooke, Inc. (Honduras).
C. J. Ravelo, D. L. Reddell, E. A. Hiler, and R. W. Skaggs.
Paper No. 78-2540, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois. 20 p, 7 fig, 3 tab, 24 ref.

Descriptors: Drainage practices, *Drainage systems, Computer models, Water table, Soil water, Soil-water-plant relationships, Simulation analysis, Crop production.

An improved approach is proposed for incorporating crop drainage requirements into drainage design procedures. The overall methodology links crop drainage requirements, climatological data, and drainage theory into a workable design method through incorporation of the stress-day index concept into a water management model. (See W77-05983) (Skogerboe-Colorado State)
W79-04998

4C. Effects On Water Of Man's Non-Water Activities

LONG-TERM PATTERNS OF SEDIMENT PRODUCTION FOLLOWING ROAD CONSTRUCTION AND LOGGING IN THE OREGON COAST RANGE,
Oregon State Univ., Corvallis. Dept. of Forest Engineering.
For primary bibliographic entry see Field 2J.
W79-04750

AN EVALUATION OF THE EFFECTS OF GEOTHERMAL ENERGY DEVELOPMENT ON AQUATIC BIOTA IN THE GEYSERS AREA OF CALIFORNIA,
California Univ., Berkeley. Div. of Entomology and Parasitology.
For primary bibliographic entry see Field 6G.
W79-04962

4D. Watershed Protection

CORN RESIDUE MANAGEMENT TO REDUCE EROSION IN IRRIGATION FURROWS,
Science and Education Administration, Prosser, WA. Agricultural Research.
J. S. Aarstad, and D. E. Miller.
Journal of Soil and Water Conservation, Vol. 33, No. 6, p 289-291, November-December 1978. 5 tab, 4 ref.

Descriptors: *Erosion control, *Furrow irrigation, *Farm management, On-site investigations, Crops, Corn, Irrigation, Sediments, Turbidity, Runoff, Infiltration, Erosion, Agriculture, *Tillage practices, Crop residues.

Three tillage systems--clean tillage, disking, and till-planting, including furrowing--were evaluated to determine the effects of corn residues on furrow erosion, runoff water turbidity, and infiltration rates under furrow irrigation on medium-textured soils. Disking and till-planting left corn residue in the irrigation furrows. This essentially eliminated soil erosion and increased infiltration rates compared with clean tillage. Tail-water leaving the trashy furrows was often less turbid than that entering the field. Surface residues did not affect corn yields adversely. (Sims-ISWS)
W79-04724

ECONOMICS OF ON-FARM METHODS OF CONTROLLING SEDIMENT LOSS FROM SURFACE-IRRIGATED FIELDS,
L. R. Conklin, K. H. Lindenborg, E. L. Michalson, and R. B. Long.
The Journal of Soil Science (Idaho Agricultural Experimental Station Bulletin), Vol. 29, No. 3, p 1-23, September 1978. 8 fig, 28 tab.

Descriptors: *Costs, *Surface irrigation, *Soil erosion, *Methodology, *Soil management, *Sedimentation ponds, Vegetative strips, Sprinkler irrigation, Settling basins, Farm ponds, Irrigation, Economics, Idaho, Magic Valley(ID), Boise Valley(ID), Sediments, Sedimentation, Soil conservation, Farm management, Crop production, Valleys, Crops, Cost-effectiveness, Model studies, Water pollution control, Flow cutback.

Sediment losses in the Magic and Boise Valleys of southern Idaho could be reduced 50-66% at modest cost; the finding is based on evaluation of five reduction methods weighed against farm income considerations. Losses can be reduced using on-farm sediment ponds dug into a waterway, or vegetative buffer strips for grain. Ponds would cost an average of $475 annually on small farm models and $950 annually on large farm models. Net returns to land and management with the ponds are reduced slightly over 1%. Compared with sediment ponds, minibasins on the lower end of a field increase sediment retained on model farms for all crops except potatoes, but increase costs. For both farm model sizes, minibasins reduce average sediment loss by 82%; for small farm models sediment losses of 500 tons are reduced to 90 tons, and for large models from 1000 to 185 tons. Average annual costs are $1000 and $2175 respectively, and net returns to land and management are lowered by slightly over 2.5%. Elimination of surface runoff and sediment losses would require sprinkler irrigation, which would cost an average of $5650 on small farm models and $11,600 on large farm models, and decrease net returns to land and management by about 15% in both cases. Flow cutback was the most expensive method as it reduced sediment loss by only 30%. (Lynch-Wisconsin)
W79-04756

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

DISTRIBUTION OF STABLE ORGANIC MOLECULES IN THE MARINE ENVIRONMENT: PHYSICAL CHEMICAL ASPECTS. CHLORINATED HYDROCARBONS,
URS Co., Seattle, WA.
For primary bibliographic entry see Field 5C.
W79-04559

VOLATILE LIQUID HYDROCARBONS IN THE SURFACE COASTAL WATERS OF THE GULF OF MEXICO,
Texas A and M Univ., College Station. Dept. of Oceanography.

For primary bibliographic entry see Field 5C.
W79-04560

NUTRIENT BUDGET FOR A RESIDENTIAL STORMWATER CATCHMENT IN DURBAN, SOUTH AFRICA,
National Inst. for Water Research, Congella (South Africa). Regional Lab.
For primary bibliographic entry see Field 5B.
W79-04565

DETERMINING NUTRIENT LOADING FROM RAINFALL AND RUNOFF IN SMALL RIVERS,
Technische Univ., Hanover (Germany, F.R.). Inst. fuer Wasserwirtschaft, Hydrologie und Landwirtschaftlichen Wasserbau.
For primary bibliographic entry see Field 5B.
W79-04566

URBAN RUNOFF FROM A ROAD SURFACE--A WATER QUALITY STUDY,
Imperial Coll. of Science and Technology, London (England).
For primary bibliographic entry see Field 5B.
W79-04567

ATMOSPHERIC FALLOUT AND STREET CLEANING-EFFECTS ON URBAN STORM WATER AND SNOW,
Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Water Supply and Sewerage.
For primary bibliographic entry see Field 5B.
W79-04568

NITRATES IN WATER SUPPLY ABSTRACTIONS IN THE ANGLIAN REGION: CURRENT TRENDS AND REMEDIES UNDER INVESTIGATION,
Anglian Water Authority (England). Public Health and Water Supplies.
L. A. Greene.
Water Pollution Control, Vol 77, No 4, p 478-491, 1978. 7 fig, 3 tab, 11 ref.

Descriptors: *Nitrates, *Water supplies, *Rivers, *Groundwater, Surveys, Nitrogen, Water pollution, Fertilizers, Sewage effluents, Potable water, Water treatment, Water resources, Water chemistry, Water quality, Water quality standards, Water pollution control, *England, Pubic health.

Existing reports indicated that prior to the formation of the regional water authorities in 1974, a number of groundwater sources in the Anglian region possessed nitrate concentrations in excess of the World Health Organization recommended level for drinking water. A regional survey in 1975 indicated that 50 public supply boreholes, wells, and springs accounting for about 160 tcmd had recorded nitrate levels in excess of 11.3 mg/l (as nitrogen); 12 of these sources had recorded levels in excess of 15 mg/l nitrate-N. The major 'problem' abstractions were identified in the East Anglian chalk aquifers and the Lincolnshire limestone. Lack of data on many groundwater sources prevented a fully comprehensive survey of all public-supply groundwater abstractions being carried out at that time. Additionally, the regional survey indicated that prior to 1974, 445 tcmd of surface-derived supplies had exceeded 11.3 mg/l nitrate for brief periods; about 15% (by volume) were direct river abstractions and the remainder were pumped storage impoundment intakes. In this latter situation it was noted that nitrate concentrations in impoundments were reduced by 40-50% as assessed on the basis of annual maximum and minimum concentrations at the point of abstraction. One small direct river abstraction supply in Suffolk, located in a wholly agricultural catchment with no sewage effluent discharges, was found to have consistently contained more than 11.3 mg/l nitrate-N for a number of years. (Sims-ISWS)
W79-04570

KINETIC ANALYSIS OF INTERACTIVE EFFECTS OF CADMIUM AND NITRATE ON GROWTH OF THALASSIOSIRA FLUVIATILIS (BACILLARIOPHYCEAE),
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Oceanography.
W. K. W. Li.
Journal of Phycology, Vol. 14, p 454-460, 1978. 2 tab, 6 fig, 30 ref.

Descriptors: *Cadmium, *Metals, Water pollution effects, *Bioassay, Laboratory tests, Growth rates, *Growth kinetics, Sea water, *Nitrates, Isochrysis, Thalassiosira, Nutrients, Growth inhibition.

The effect of cadmium on growth rates of Thalassiosira and Isochrysis at non-limiting nutrient concentrations is described by the Lerusalimskii equation. At limiting nitrate concentrations, the effect of Cd on growth rate of T. fluviatilis is described by analogy to the general equation of enzyme inhibition in which the reaction involves a single intermediate. When cells are stressed by Cd, not only is the maximum growth rate reduced, but the half-saturation growth parameter is increased. Results show that for T. fluviatilis, the degree of inhibition by Cd is more severe at low than at high NO3 levels but the difference in severity diminishes as Cd concentration increases. (Katz-EIS)
W79-04587

THE UPTAKE AND RELEASE OF PETROLEUM HYDROCARBONS BY THE MARINE MUSSEL MYTILUS EDULIS,
Vandkvalitetsinstitutet, Hoersholm (Denmark).
N. Hansen, V. B. Jenson, H. Appelquist, and E. Morch.
Progress in Water Technology, Vol. 10, No. 5-6, p 351-359, 1978. 2 fig, 2 tab, 26 ref.

Descriptors: *Mussels, *Oil, *Absorption, Aromatic compounds, Organic compounds, Oil pollution, Radioactivity techniques, Tracers, Animal metabolism, Animal physiology, Path of pollutants, Lipids, Carbon radioisotopes, *Bioaccumulation, *Tissue analysis, *Naphthalene, *Toluene, *Depuration.

Mussels were exposed to seawater solutions of four radiolabelled hydrocarbons. The aromatic hydrocarbons were rapidly accumulated. Bioaccumulation factors were determined to about 4 for toluene, about 30 for naphthalene, and more than 70 for phenanthrene. The bioaccumulation factors were found independent of the water concentration level. When transferred to clean seawater the hydrocarbons were released, toluene and naphthalene very rapidly, phenanthrene more slowly. Hexadecane was taken up and released very slowly. During 8 hours' exposure to hexadecane the concentration in the mussels did not reach the concentration in the water. The coefficients of variation of hydrocarbon accumulation between individual mussels were determined and found between 18 and 32%. The results support the theory that uptake and release of hydrocarbons are passive processes dependent or partitioning between the water and the tissue lipids. (DEAL-EIS)
W79-04588

CONTENTS OF TOTAL MERCURY, ALKYL MERCURY, AND METHYL MERCURY IN SOME COASTAL FISH AND SHELLS,
Yamaguchi Prefectural Research Inst. of Health (Japan).
H. Kumagai, and K. Saeki.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 44, No. 7, p 807-811, 1978. 2 fig, 5 tab, 26 ref.

Descriptors: *Mercury, *Shellfish, *Analytical techniques, Heavy metals, Chemical analysis, Path of pollutants, Water quality, Pollutant identification, Crustaceans, Gastropods, Aromatic compounds, Organic compounds, Fish physiology, *Methylmercury, *Alkyl mercury, *Mercury compounds, *Tissue analysis.

This investigation was conducted in an attempt to clarify the levels of total, alkyl, and methyl mercuries in the fish and shells caught in coastal waters where mercurial pollution was not assumable. The development of analytical procedures for mercury determination made it possible to conduct an extensive survey of the mercury distribution in the fish and shells available at Yamaguchi and adjacent waters. The results obtained are as follows: (1) The results of the analysis for total mercury were that mean values of 0.069, 0.078, 0.058, and 0.041 ppm were obtained in the edible portions of fish, crustacean, cephalopod, and bivalve and gastropod groups respectively, with wide within-group variation. (2) No lower alkyl mercuries, except methyl mercury, were detected in any of the samples. It is conceivable, therefore, that the content of lower alkyl mercury coincides with that of methyl mercury when the sample is obtained from coastal waters probably uncontaminated with mercury. Mean values of methyl mercury in the edible portion of the four above-mentioned groups were 0.046, 0.009, 0.025, and 0.008 ppm respectively. (3) the mean ratios of methyl mercury to total mercury in the edible portion of the four groups were 0.67, 0.46, 0.70, and 0.18 respectively. (Deal-EIS)
W79-04589

PHYTOPLANKTON ECOLOGY OF VANCOUVER HARBOR,
Fisheries and Marine Service, Vancouver (British Columbia). Dept. of Fisheries and Ocean.
For primary bibliographic entry see Field 5B.
W79-04617

NO. 2 FUEL OIL DECREASES EMBRYONIC SURVIVAL OF GREAT BLACK-BACKED GULLS,
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.
For primary bibliographic entry see Field 5C.
W79-04628

INCREASED SPONTANEOUS LOCOMOTOR ACTIVITY IN THE FIDDLER CRAB, UCA PUGILATOR, AFTER EXPOSURE TO A SUBLETHAL CONCENTRATION OF DDT,
Tulane Univ., New Orleans, LA. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W79-04629

BIOLOGICAL SURVEILLANCE OF RIVERS: A BIOLOGICAL MONITORING HANDBOOK,
Water Pollution Research Lab., Stevenage. (England).
For primary bibliographic entry see Field 7B.
W79-04634

A COLORIMETRIC ANALYSIS FOR ABIETIC-TYPE RESIN ACIDS IN PULPING EFFLUENTS,
MacMillan Bloedel Ltd., Vancouver (British Columbia).
K. L. McDonald.
Tappi, Vol. 61, No. 10, p 77-79, October, 1978. 1 fig, 9 ref.

Descriptors: *Pulp wastes, *Resin acids, *Waste identification, Abietic acids, Organic acids, Wastes, Industrial wastes, Water pollution sources, Colorimetry, Analytical techniques, Pulp and paper industry, Effluents, Toxicity, Canada, Foreign countries, Kraft mills.

At MacMillan Bloedel Research Ltd. (Vancouver, Canada), resin acids in kraft pulp mill effluents were recovered by solvent extraction and quantitatively determined using a colorimetric technique in which abietic acid in alkaline solution is reacted with a diazonium salt, viz., 1-amino-2-naphthol-4-sulfonic acid. Recovery was not quantitative but could be calculated for a given set of conditions and the analytical results adjusted accordingly. Quantities of less than 1 ppm of resin acids were determined with a +12% relative standard deviation at the 10-ppm level. The effect of interference by unsaturated acids and sterols was not severe, and stability of the developed color was better than in the current Carpenter procedure; cf. Tappi, Vol. 48, No. 11, p 669-671, 1965. The 2-

amino-2-methyl-1-propanol salt of levopimaric acid is recommended as a stable resin acid standard. (Switchtenberg-IPC)
W79-04636

A COMPUTER MONITORED AQUATIC BIOASSAY SYSTEM,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
K. W. Thompson, K. L. Dickson, D. Hooley, J. Cairns, Jr., and W. H. Van der Schalia.
In: Proceedings of the Tenth Mid-Atlantic Industrial Waste Conference, p 61-66, 1978. J. B. Carberry, Ed. University of Delaware. 7 fig, 9 ref.

Descriptors: *Fish behavior, *Research equipment, *Bioassay, Respiration, Monitoring, Fish physiology, Electrical equipment, Toxicity, Automatic control, Computers, Data collections, Sunfishes.

Increased use of aquatic resources and related legislation have led to elevated demands for bioassay information. The need to produce large amounts of reliable bioassay data is facilitated by the utilization of available electronic technology since it reduces costs and makes the handling of large amounts of data feasible. An electronic system which can detect the action potential generated by muscle activity in the branchial region of a fish during ventilatory activity is reported. This equipment facilitates the monitoring of the sub-lethal effects of toxicants on ventilatory behavior. (Deal-EIS)
W79-04652

STUDIES ON THE POST-MORTEM IDENTIFICATION OF THE POLLUTANT IN FISH KILLED BY WATER POLLUTION - XIII CADMIUM (IN JAPANESE),
Tohoku Univ., Sendai (Japan). Dept. of Fisheries.
T. Kariya, H. Haga, Y. Haga, and Y. Kawasaki.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 44, No. 10, p 1065-1072, 1978. 4 fig, 8 tab, 7 ref. (English abstract).

Descriptors: *Bioassay, *Toxicity, *Cadmium, *Mortality, Metals, Lethal limit, Laboratory tests, Path of pollutants, Absorption, Industrial wastes, Heavy metals, Pollutants, Water pollution sources, Freshwater fish, *Bioaccumulation, *Carassius, Tissue analysis, Cadmium plating, Cadmium compounds.

The toxicity of several cadmic solutions to fishes and cadmium content in fish bodies killed with these solutions were investigated. The 48 h TLm values for goldfishes for CdCl2, Cd(CN)2, and Cd-plating solution III were 5 to 10 ppm Cd and those for Cd-plating solutions I and II were approximately 0.3 ppm Cd. Thus, the latter is more toxic than the former. These latter solutions had toxicities greater than that indicated by CN concentration in them. Greater fish mortality and cadmium content in fish bodies were observed for non-feeding group than for feeding group, in CdCl2 solution containing 0.1 ppm of Cd which is considered to be at the semi-acute level. Cadmium concentration was higher in hepatopancreas than in kidneys for the feeding group and vice versa for the non-feeding group. The analysis of whole fish bodies revealed large cadmium contents for the fishes killed with CdCl2, Cd(CN)2, and Cd-plating solution III; for the fishes killed with Cd-plating solutions I and II, high cadmium content was observed only in the case of larger cadmium concentration in those solutions. (Katz-EIS)
W79-04694

AN AUTOMATED DEVICE (AGARS) FOR STUDYING AVOIDANCE OF POLLUTANT GRADIENTS BY AQUATIC ORGANISMS,
University of West Florida, Pensacola. Faculty of Biology.
C. R. Cripe.
Available from the National Technical Information Service, Springfield, VA 22161 as Journal of the Fisheries Research Board of Canada, Vol. 36, No. 1, p 11-16, 1979. 3 fig, 14 ref.

Descriptors: *Bioassay, *Laboratory tests, Laboratory animals, Monitoring, *Methodology, *Chlorine, Fish behavior, Fish physiology, Avoidance responses, Behavioral bioassays, Toxicity, Gradients, Chlorination, Lagodon, Aquatic gradient avoidance response system, Chlorine produced toxicants.

Most apparatus designed to detect avoidance of pollutants by aquatic organisms require visual observations of test organisms in steep pollutant gradients. AGARS (Aquatic Gradient Avoidance Response System) was developed to eliminate these limitations. This system allows animals to choose between one uncontaminated zone and three increasingly toxic zones in a gradient trough that is monitored for extended time periods by infrared light sources, sensors, and a microprocessor. Data are accumulated hourly and processed by a paper tape reader/calculator/plotter system that records the time test animals remain in each zone and compares behavior before and during test exposures. Initial tests indicate that pinfish (Lagodon rhomboides) tested in the apparatus will avoid chlorine-produced oxidants at concentrations of 0.02-0.04 mg/L. (Katz-EIS)
W79-04696

A GEOGRAPHICALLY VARIABLE WATER QUALITY INDEX USED IN OREGON,
Oregon Dept. of Environmental Regulation, Salem. Water Quality Div.
D. A. Dunnette.
Journal of the Water Pollution Control Federation, Vol. 51, No. 1, p 53-61, January 1979. 7 fig, 4 tab, 23 ref.

Descriptors: *Water quality index, *Water quality criteria, *Regions, *Planning, *Oregon, Basins, Streams, Mathematical models, Systems analysis, Seasonal variations, Willamette River basin(Ore), Parameter selection, Aggregation.

An Oregon Water Quality Index has been developed which takes into consideration differences in water quality resulting from geographical characteristics of separate basins. The index was developed for the purpose of providing a simple, concise, and valid method for expressing the significance of regularly generated laboratory data. The trend-monitoring value of the index was demonstrated for two quite different Willamette River stations. Correlations among this and several other proposed indexes averaged 0.87. Yearly and seasonal variations in water quality were quantitized and found to average 88.9 and 78.9 Oregon Water Quality Index units for the higher and lower water quality stations respectively over the period 1971-1976. Calculated rates of change in water quality were +0.68 and +0.91 Oregon Water Quality Index units/year for the two stations for 1971-1976. The Oregon Water Quality Index is now used routinely in that state's primary station sampling program to recognize water quality trends. (Bell-Graf-Cornell)
W79-04697

COMPARISON OF A HIGH VOLUME PUMP AND CONVENTIONAL PLANKTON NETS FOR COLLECTING FISH LARVAE ENTRAINED IN POWER PLANT COOLING SYSTEMS,
Lockheed Center for Marine Research, Carlsbad, CA.
R. M. Leithiser, K. F. Ehrlich, and A. B. Thum.
Journal of the Fisheries Research Board of Canada, Vol. 31, No. 1, p 81-84, 1979. 1 fig, 2 tab, 9 ref.

Descriptors: *Power plants, *Larval growth stage, Juvenile fish, Larval fish, *Methodology, Cooling water, Pumps, Pump testing, Zooplankton, Plankton nets, *Fish sampling, Entrainment.

A high volume pump (2.5 m3/min capacity at 6 m head) and conventional plankton nets (0.5 and 1.0 m diam) 2343 operated side by side in two tests to evaluate the efficiency for each gear for sampling fish larvae within the intake structure of a coastal power plant. At intake channel current velocities up to 40 cm/s (the maximum tested), the pump in one test caught significantly more fish larvae than the nets. Compared to the pump, both sizes of plankton nets in each test greatly undersampled large larvae (over 5.0 mm total length). Our findings suggest that conclusions regarding ichthyoplankton entrainment based on data obtained with conventional plankton nets may be of questionable validity. (Katz-EIS)
W79-04703

LABORATORY STUDIES OF GAS TRACERS FOR REAERATION,
Geological Survey, Bay St. Louis, MS.
R. E. Rathburn, D. W. Stephens, D. J. Shultz, and D. Y. Tai.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. EE2, p 215-229, April 1978. 6 fig, 3 tab, 23 ref.

Descriptors: *Water quality, *Oxygenation, *Aeration, Gases, Absorption, Analytical techniques, Effects, Contaminants, Tracers, Reaeration, Laboratory tests, Least-squares method, Data analysis, Calculation procedures, Systems analysis, Equations.

Laboratory studies have been conducted to determine the rates at which ethylene and propane desorb from a water bath relative to the rate at which oxygen is absorbed by the same water. The ratios between the oxygen absorption coefficient and the hydrocarbon desorption coefficient are 1.15 and 1.39 for ethylene and propane, respectively. These ratios serve as the basis for a tracer technique for measuring reaeration coefficients of streams. Comparison of 2-parameter and 3-parameter procedures shows that the 3-parameter procedure is able to fit the data better in terms of a root-mean-square error. However, estimates of the saturation concentration for dissolved oxygen with the 3-parameter procedure are unrealistic. Therefore, a 2-parameter procedure with the saturation concentration fixed at a literature value for the specific temperature and corrected for barometric pressure has been used. The 2-parameter procedure has also been used for the hydrocarbon data with the equilibrium concentration fixed at zero. (Bell-Graf-Cornell)
W79-04712

TRANSPORT OF NUTRIENTS AND CARBON FROM THE NANAIMO RIVER TO ITS ESTUARY,
Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station.
For primary bibliographic entry see Field 2L.
W79-04726

FACTORS CONTROLLING THE ESTUARINE CHEMISTRY OF ARSENIC,
Skidaway Inst. of Oceanography, Savannah, GA.
For primary bibliographic entry see Field 2L.
W79-04728

COMPARATIVE STUDY OF THE FIXATION OF INORGANIC MERCURY ON THE PRINCIPAL CLAY MINERALS AND THE SEDIMENTS OF THE LOIRE ESTUARY,
Nancy-1 Univ. (France). Lab. de Toxicologie.
For primary bibliographic entry see Field 2L.
W79-04730

PARALYTIC SHELLFISH TOXINS IN THE SEA SCALLOP, PLACOPECTEN MAGELLANICUS, IN THE BAY OF FUNDY,
Rhode Island Univ., Kingston. Coll. of Pharmacy.
C. P. Hsu, A. Marchand, and Y. Shimizu.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 1, p 32-36, 1979. 1 fig, 1 tab, 20 ref.

Descriptors: *Toxicity, *Public health, *Commercial shellfish, Zooplankton, Protoza, Dinoflagellates, Chemical analysis, Molluscs, Toxin, Paralytic

shellfish poison, Gonyautoxin, Neosaxitoxin, *Gonyaulax, Ba of Fundy.

The paralytic shellfish poison of the giant sea scallop, Placopecten magellanicus, from the Bay of Fundy has been analyzed. Of eight toxins isolated, seven were identified with those previously recognized in various sources including the Atlantic toxic dinoflagellate, Gonyaulax tamarensis cells. The major components were gonyautoxin-I, gonyautoxin-II, and neosaxitoxin; saxitoxin was responsible for only a very small portion of the total toxicity. A minor toxin that was eluted between neosaxtoxin and saxitoxin in the chromatography system was found to be new and designated as gonyautoxin-VII. (Katz-EIS)
W79-04825

ZINC CONTENT OF THE GILLS OF RAINBOW TROUT (S. GAIRDNERI) AFTER TREATMENT WITH ZINC SOLUTIONS UNDER NORMOXIC AND HYPOXIC CONDITIONS,
Bristol Univ. (England). Research Unit for Comparative Animal Respiration.
For primary bibliographic entry see Field 5C.
W79-04836

THE HYDROLYSIS OF AMMONIUM IONS IN SEA WATER-EXPERIMENTAL CONFIRMATION OF PREDICTED CONSTANTS AT ONE ATMOSPHERE PRESSURE,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
M. Whitfield.
Journal of the Marine Biological Association of the United Kingdom, Vol 58, p 781-787, 1978. 15 ref, 6 tab.

Descriptors: *Chemical reactions, *Ammonium salts, *Toxicity, *Aquiculture, *Hydrolysis, *Nitrogen cycle, Ammonium compounds, Nitrogen compounds, Chemical analysis, Water pollution sources, Water quality, Water quality control, Ions, Sea water, Pollutant identification, Mathematical models, Water temperature.

Recent experimental measurements have confirmed the accuracy of earlier calculations of the extent of hydrolysis of ammonium ions in sea water over a range of temperature and salinity. Tables of the percentage of un-ionized ammonia in sea water compiled from the calculated data can therefore be used with confidence in assessing ammonia toxicity in mariculture systems. (Katz-EIS)
W79-04844

ACUTE TOXICITY OF 12 INDUSTRIAL CHEMICALS TO FRESHWATER AND SALTWATER ORGANISMS,
Rice Univ., Houston, TX. Dept. of Biology; and Rice Univ., Houston, TX. Dept. of Environmental Science and Engineering.
M. W. Curtis, T. L. Copeland, and C. H. Ward.
Water Research, Vol. 13, p. 137-141, 1979. 6 tab, 9 ref.

Descriptors: *Toxicity, *Industrial wastes, *Bioassay, Chemical wastes, Organic compounds, Minnows, Shrimp, Ammonium compounds, Arsenic compounds, Copper compounds, Chlorides, Sodium compounds, Physiocochemical properties, Aquatic animals, *Palaemonetes, *Pimephales, *Penaeus.

Aquatic animal toxicity is a major criterion used by the U.S. EPA to designate and classify hazardous substances other than oil. This research developed basic toxicity data for twelve industrial chemicals with which little or no previous testing had been done. Static 96 h toxicity tests were performed with one freshwater species (fathead minnow) and one saltwater species (grass shrimp or white shrimp) on the following chemicals: ammonium fluoride, arsenic trisulfide, benzoyl chloride, benzyl chloride, cupric acetate, o-dichlorobenzene, p-dichlorobenzene, mercuric acetate, mercuric thiocyanate, resorcinol, sodium hypochlorite and toluene-2,4-diisocyanate (TDI). As defined by 96 h LC50's plus or minus 500 mgl-1, all 12 chemicals were hazardous to freshwater minnows, and all but TDI were hazardous to saltwater shrimp. The physicochemical behaviors of the compounds greatly influenced their aquatic toxicities. (Deal-EIS)
W79-04845

A NEW AQUARIUM FOR THE STUDY OF TEMPERATURE BEHAVIOUR OF FISH,
Norsk Inst. for Vannforskning, Blindern (Norway).
G. B. Nilsen, and K. H. Roed.
Sarsia, Vol. 63, No. 4, p 199-202, 1978. 7 ref, 4 fig.

Descriptors: *Water temperature, *Methodology, *Fish behavior, *Aquaria, *Equipment, Sticklebacks, Bioassay, Behavior, Aquatic environment, Laboratory tests, Temperature, *Temperature gradient, *Gasterosteus.

The aquarium is based on stable vertical temperature gradients. Different sections, where temperatures can be regulated by the incoming water, are separated by partitions allowing free passage of fish between each section. Seepage of water between the sections is prevented by varying the water levels of the different sections through the outflow system. The temperature distribution in the aquarium is monitored. Testing of the stability of the system was made by adding ink to the water supply of one of the sections. The utility of the system was demonstrated on the three-spined stickleback, Gasterosteus aculeatus. (Katz-EIS)
W79-04846

AMBIENT CONCENTRATIONS OF PCBS IN THE SOUTHEAST FROM STORET DATA AND SELECTED EPA STUDIES,
Environmental Protection Agency, Athens, GA. Surveillance and Analysis Div.
R. J. Bruner, and D. W. Hill.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 042, Price codes: A03 in paper copy, A01 in microfiche. Report No. EPA-904/9-77-032, 1977. 22 p, 3 fig, 8 tab, 6 ref.

Descriptors: *Polychlorinated biphenyls, *Pesticide residues, Aromatic compounds, Chlorinated hydrocarbon pesticides, Sediments, Water chemistry, Water quality, Chemical analysis, Lakes, Food chains, Public health, Fish physiology, Animal metabolism, Bass, Sunfishes, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Tennessee, Kentucky, *Tissue analysis, *Bioaccumulation, *Biomagnification.

The PCB problem in the southeast came to light in 1976 with the discovery of high concentration of PCBs in fish tissues collected from Lakes Weiss and Hartwell. Tissue, sediment and water data from these lakes are reported and analyzed. Big Cypress Swamp data are presented and analyzed to determine background concentrations of PCBs in areas remote from human activities. STORET data for the States of NC, SC, GA, FL, AL, MS, TN and KY were analyzed and potential problem areas are defined. The extent of the PCB problem is evaluated and recommendations are made regarding future sampling needs. (DEAL-EIA)
W79-04848

FLUX OF CERTAIN RADIONUCLIDES IN THE BLOOD-CLAM ANADARA GRANOSA LINNEAUS UNDER ENVIRONMENTAL CONDITIONS,
Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.
B. Patel, S. Patel, M. C. Balani, and S. Pawar.
Journal of Experimental Marine Biology and Ecology, Vol. 35, p 177-195, 1978. 7 fig, 7 tab, 28 ref.

Descriptors: *Clams, *Path of pollutants, *Radioisotopes, *Caesium, *Radioactive wastes, Absorption, Commercial shellfish, Public health, Cobalt radioisotopes, Animal physiology, Metabolism, Invertebrates, Benthic fauna, Mollusks, Sediments, On-site investigation, *Bioaccumulation, *Cerium, *Ruthenium, *Anadara.

The flux of fission product nuclides, caesium-137, cerium-144, and ruthenium-106, in the Bombay Harbor ecosystem was measured over a period of six years during which the input of controlled low level radioactive waste was reduced by more than 20 times. The arcid clam Anadara granosa showed a specific affinity for all three radionuclides with the greatest bioaccumulation of cerium and least of caesium. The concentration of these nuclides varied with levels in the sedimentary material. On reaching maximum accumulation the levels of all three nuclides in the clam population decreased exponentially with time although the radioactivity was still available especially in the sediment. This decrease of radioactivity is defined as an 'ecological loss rate', which was 3-6 times longer than the physical half-life of cerium-144 and ruthenium-106, but was significantly shorter for caesium-137. The bioaccumulation of an activation product nuclide cobalt-60 increased with the time of exposure but was independent of the ambient concentrations and temperature. The species was found to maintain the tissue concentration of fission product nuclides through adjusting physiological flux rates in equilibrium with changing levels in the environmental matrices, but not of the activation product nuclide cobalt-60. (Katz-EIS)
W79-04849

ENVIRONMENTAL QUALITY RESEARCH. USE OF UNICELLULAR ALGAE FOR EVALUATION OF POTENTIAL AQUATIC CONTAMINANTS. SECOND ANNUAL REPORT,
California Univ., Irvine.
J. Scherfig, P. S. Dixon, C. A. Justice, and R. A. Appleman.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A051 327, Price codes: A02 in paper copy, A01 in microfiche. Aerospace Medical Research Laboratory, Report No. AMRL-TR-77-53, Air Force Systems Comman, Wright-Pattersen AFB, Ohio, 25 p, 1977. 6 fig, 17 tab, 6 ref.

Descriptors: *Bioassay, Fuels, *Algae, *Chlorophyta, Organic compounds, Chemical properties, Chemical analysis, Chemical reactions, Toxicity, Chemical wastes, Nutrients, Salinity, Food chains, *Selenastrum, *Dunaliella, Rocket fuels, *Hydrazine.

Selenastrum capricornutum and Dunaliella tertiolecta were used as test algae in bioassays to determine the toxic and/or biostimulating effects of hydrazine and methylated hydrazines in various fresh water and marineaquatic environments. Standard batch algal assay procedures were used to determine safe concentrations and effective concentrations for the compounds studied. Chemical analyses were performed to determine compound stability under the various test conditions. (Deal-EIS)
W79-04850

RAPID, QUANTITATIVE DETERMINATION OF BACTERIA IN WATER,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
E. W. Chappelle, G. L. Picciolo, R. R. Thomas, E. L. Jeffers, and J. Deming.
Available from the National Technical Information Service, Springfield, VA 22161 as N78-22585, Price codes: A03 in paper copy, A01 in microfiche. NASA Case Number GSC-12158-1, 1978. 40 p. 5 fig.

Descriptors: *Analytical techniques, *Bioluminescence, *Aquatic bacteria, Enzymes, Biochemistry, Chmical analysis, Bacteria, Biomass, Laboratory equipment, Filters, Cytological studies, Water quality, *Luciferase, *ATP, *Chemiluminescence.

An invention that speeds the quantitative analysis of bacteria in water is reported. A synthetic polymer hollow fiber filter/concentrator is employed to concentrate bacteria in a water samply by either forcing the water across the filter or by recirculating the water through the filter to remove the filtrate. A system for automating bacteria concentration employng the filter/contractor is provided.

A bioluminescent and a chemiluminescent assay for making a quantitative determination of waterborne bacteria is also provided. The bioluminescent assay employs a luciferase-luciferin mixture reaction while the chemiluminescent assay employs a luminol reaction. (Deal-EIS)
W79-04877

IMPINGEMENT AND ENTRAINMENT OF FISHES AT THE SAVANNAH RIVER PLANT AND NPDES 316B DEMONSTRATION,
DuPont de Nemours (E.I.) and Co., Aiken, SC. Savannah River Lab.
For primary bibliographic entry see Field 5B.
W79-04879

THE POTENTIAL IMPACTS ON AQUATIC ECOSYSTEMS FROM THE RELEASE OF TRACE ELEMENTS IN GEOTHERMAL FLUIDS,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5B.
W79-04881

METHOD FOR DETECTING WATER POLLUTANTS,
Department of the Army, Washington, DC.
M. K. Razulis.
U.S. Patent No. 4,125,376, 5 p, 1 fig, 8 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 2, p 541, November 14, 1978.

Descriptors: *Patents, *Sampling, *Water pollution, *Water pollution sources, Water analysis, On-site tests.

An improved method for identification and qualitative determination of potentially harmful pollutants in water through the use of a sampling test tube apparatus consists essentially of a test tube containing a foam cube which has been impregnated with a detection chemical solution selected to react colorimetrically with specific pollutants to be detected. The invention provides a simple on-site analytical test procedure for rapid, sensitive and specific identification of water born substances. Also the process can obtain more reproducible differentiation between known chemicals and biological compounds in water without the need for technically trained personnel. (Sinha-OEIS)
W79-04897

TRACE ELEMENTS IN THE SEDIMENTS OF THE BUFFALO RIVER, ARKANSAS,
Arkansas Univ., Fayetteville.
G. H. Wagner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 916, Price codes: A05 in paper copy, A01 in microfiche. Master of Science Thesis, 1974. 86 p, 27 fig, 18 tab, 19 ref, 1 append. OWRT A-025-ARK(1).

Descriptors: *Trace elements, *Pollutant identification, *Chemical analysis, Rivers, *Arkansas, Environment, Environmental effects, Sediments, *Buffalo River(AR).

Samples were taken over 130 miles of the Buffalo River in northern Arkansas in order to determine trace elements present in sediments. Aqua regia extracts of the minus 95 mesh fraction of the sediments were analyzed by atomic absorption for sodium, potassium, magnesium, calcium, zinc, cadmium, copper, lead, arsenic, mercury, iron, cobalt, chromium, nickel, and manganese. Zirconium and total iron were determined by x-ray fluorescence. There was a general decrease downstream in iron, copper, chromium, nickel, maganese, lead, potassium, and sodium as the drainage area increased in carbonate rock and decreased in shale. The elements magnesium, clacium, zinc, and cadmium increased in sediments downstream. Cobalt was generally low and constant. The sediments sampled were mainly quartz and chert. These grains are apparently coated with hydrous iron oxide which acts as a sorbent for cobalt, chromium, nickel, copper, manganese, and potassium. Other elements, particularly magnesium, calcium, zinc, cadmium, lead, and zirconium, are mostly carried in the stream in clastic grains. Anomalously high concentrations of these latter elements occurred near old mill sites and known mineral deposits. It was concluded that zinc and cadmium were sufficiently high near old mill sites to warrant concern as pollutants. (Wares-IPA)
W79-04956

STUDIES ON THE UPTAKE OF CADMIUM BY THE CRAB CARCINUS MAENAS IN THE LABORATORY. I. ACCUMULATION FROM SEAWATER AND A FOOD SOURCE,
Queen Mary Coll., London(England). Dept. of Zoology and Comparative Physiology.
J. R. Jennings, and P. S. Rainbow.
Marine Biology, Vol. 50, p 131-139, 1979. 4 tab, 16 ref.

Descriptors: *Cadmium, *Absorption, *Crabs, Brine Shrimp, Animal physiology, Animal metabolism, Heavy metals, Path of pollutants, Radioactivity techniques, Tracers, Chemical analysis, Food chains, Predation, *Tissue analysis, *Bioaccumulation.

The crab Carcinus maenas was exposed to radioactivity labelled cadmium dissolved in seawater at concentrations of 0.1, 1 and 10 ppm, the latter concentration being toxic to the crabs (50% mortality after 12.3 days). Net accumulation of cadmium from solution was proportional to the level and time period of cadmium exposure. The highest tissue concentration was found in the midgut gland, reaching 0.786 mg Cd g-1 dry weight after 12.3 days average exposure to 10 ppm Cd. The midgut gland only contained about 10% of the total cadmium absorbed from solution, while the exoskeleton contained the bulk of absorbed cadmium (59 to 80%) probably passively adsorbed onto the surface. When cadmium was absorbed by the crabs from a food source, the midgut gland contained 16.9% of the total cadmium whereas the exoskeleton now contained only 22.2%. Ten percent of the cadmium available in the food source (Artemia salina) was accumulated by the crabs. When placed in cadmium-free seawater, crabs that had accumulated cadmium from solution lost 69% of the absorbed cadmium in 10 days, mostly from the exoskeleton which lost 78% of its original absorbed cadmium concentration. (See also W79-04969) (Deal-EIS)
W79-04968

STUDIES ON THE UPTAKE OF CADMIUM BY THE CRAB CARCINUS MAENAS IN THE LABORATORY. II. PRELIMINARY INVESTIGATION OF CADMIUM-BINDING PROTEINS,
Queen Mary Coll., London (England). Dept. of Zoology and Comparative Physiology.
J. R. Jennings, P. S. Rainbow, and A. G. Scott.
Marine Biology, Vol. 50, p 141-149, 1979. 7 fig, 1 tab, 21 ref.

Descriptors: Cadmium, *Absorption, *Crabs, *Proteins, Animal physiology, Animal metabolism, Biochemistry, Heavy metals, Path of pollutants, Amino acids, Chemical reactions, Chemical analysis, Water chemistry, Chromatography, *Tissue analysis.

All internally distributed water-soluble cadmium absorbed by the crab, either from solution or from a food source, is associated with protein. Water-soluble extracts of the midgut gland, muscle, gill and remaining internal body tissues (the 'rest') have been separated chromatographically and the absorbed cadmium contents of separate protein fractions measured. In the midgut gland, 'rest' and gill, cadmium is associated with protein of high (> 50,000) and low (< 6,000) molecular weight in proportion to the amount of protein present. In the muscle, cadmium is bound to high but not to low molecular weight proteins. In addition, two proteins with a high affinity for cadmium have been found with molecular weights of approximately 12,000 and 27,000. The larger cadmium-binding protein is found in the midgut gland and 'rest' (probably the haemolymph), the smaller protein in the midgut gland, 'rest' and muscle. A tentative model of the fate of water-soluble cadmium absorbed by the crab is proposed. (See also W79-04968) (Deal-EIS)
W79-04969

OCCURRENCE OF A NEW TYPE OF SHELLFISH POISONING IN THE TOHOKU DISTRICT,
Tohoku Univ., Sendai (Japan). Lab. of Food Hygiene.
T. Yasumoto, Y. Oshima, and M. Yamaguchi.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 44, No. 11, p. 1249-1255, 1978. 4 fig, 6 tab, 4 ref.

Descriptors: *Commercial shellfish, *Human pathology, *Toxins, Mussels, Toxicity, Poisons, Hazards, *Public health, Foods, Bioassay, Chemical analysis, Pollutant identification, Epidemiology, *Tissue analysis, *Shellfish poisoning, *Scallops.

A series of food poisonings resulting from eating mussels and scallops harvested in the Tohoku District occurred in late June of both 1976 and 1977. A total of 164 persons were officially documented to have suffered severe vomiting and diarrhea. Toxicity studies using mouse assay on the left-over foods and on shellfishes from the areas where the causative specimens were harvested revealed the presence of an unknown fat-soluble toxin in the hepatopancreas of the shellfishes. The dominant symptoms in human cases were diarrhea, nausea, vomiting, and abdominal pain. The onset time of these symptoms ranged from 30 minutes to a few hours after ingestion and the victims recovered after three days without any ill effects. Epidemiological data indicated that as little as 12 MU of toxin was enough to induce a mild form of poisoning in humans. (Deal-EIS)
W79-04970

EFFECT OF COPPER ON VOLUME REGULATION IN THE MARINE FLAGELLATE DUNALIELLA MARINA,
Miljostyrelsen, Charlottenlund (Denmark). Marine Pollution Lab.
For primary bibliographic entry see Field 5C.
W79-04972

UPTAKE FROM WATER AND TISSUE DISTRIBUTION OF NEPTUNIUM-237 IN CRABS, SHRIMP AND MUSSELS,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
J.-C. Guary, and S. W. Fowler.
Marine Pollution Bulletin, Vol. 9, p 331-334, 1978. 3 fig, 3 tab, 17 ref.

Descriptors: *Radioisotopes, *Absorption, *Crabs, *Shrimp, *Mussels, Radiochemical analysis, Commercial shellfish, Radioactivity techniques, Tracers, Tracking techniques, Path of pollutants, Pollutant identification, Water chemistry, Chemical analysis, Animal physiology, Animal metabolism, *Transuranic elements, *Bioaccumulation, *Tissue analysis, *Neptunium.

The uptake of 237Np has been followed in the tissues of mussels, shrimp and crabs exposed to the actinide in seawater under controlled conditions. Bioaccumulation was observed in all tissues examined with the highest concentration factors noted in the external shells of the three species. Despite some incorporation of 237Np into internal tissues, it is noteworthy that after prolonged exposure 92-98% of the organisms' total 237Np content was associated with the non-edible shells. The general behaviour of this toxic transuranic element in invertebrate tissues appears to be very similar to that of plutonium. (Deal-EIS)
W79-04975

DETERMINATION OF PETROLEUM HYDROCARBONS IN WATER, FISH AND SEDIMENTS FOLLOWING THE EKOFISK BLOWOUT,
Ministry of Agriculture, Fisheries and Food, Burnham-on-Crouch (England). Fisheries Lab.

R. J. Law.
Marine Pollution Bulletin, Vol. 9, p 321-324, 1978. 2 fig, 3 tab, 8 ref.

Descriptors: *Oil pollution, *Oil spills, Aromatic compounds, Oil, Chemical analysis, Path of pollutants, Mussels, Sediments, Marine fish, Water chemistry, Water analysis, *Tissue analysis, *Crude oil, *Aliphatic compounds.

Samples of fish, water and sediment were collected during the Ekofisk 'Bravo' blow-out and analysed for specific aliphatic and aromatic hydrocarbons. Analysis showed the presence of petroleum hydrocarbons from the blow-out in some of the water samples, but fish and sediments, collected up to a week after it began, showed no evidence of a contribution from the blow-out. (Deal-EIS)
W79-04976

5B. Sources Of Pollution

LIMNOLOGICAL ASPECTS OF LAKE MEAD, NEVADA-ARIZONA,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 2H.
W79-04506

ENVIRONMENTAL ASSESSMENT OF COAL TRANSPORTATION,
PEDCo Environmental, Inc., Cincinnati, OH.
For primary bibliographic entry see Field 5C.
W79-04531

NITRATE AND PHOSPHORUS RUNOFF LOSSES FROM SMALL WATERSHEDS IN GREAT LAKES BASIN,
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
For primary bibliographic entry see Field 5C.
W79-04535

NUTRIENT BUDGET FOR A RESIDENTIAL STORMWATER CATCHMENT IN DURBAN, SOUTH AFRICA,
National Inst. for Water Research, Congella (South Africa). Regional Lab.
D. E. Simpson, and J. Hemens.
Progress in Water Technology, Vol. 10, No. 5/6, p 631-643, 1978. 6 fig, 3 tab, 13 ref.

Descriptors: *Nutrients, *Fallout, *Rainfall, *Runoff, Watersheds(Basins), Atmosphere, Sampling, Chemical analysis, Urban runoff, Nitrogen, Phosphorus, Pollutants, Path of pollutants, Water pollution, Water pollution sources, Data processing, Analytical techniques, *South Africa, *Durban(South Africa).

Continuous measurements of nutrient deposition from atmospheric fallout and precipitation into a 6.8 ha residential catchment containing 20% impermeable surfaces in the city of Durban were made for a period of 1 year. Stormwater runoff from the catchment was recorded automatically and sampled over the same period. All forms of soluble and suspended nitrogen and phosphorus in rainfall and runoff were determined. The influence of the amount and intensity of rainfall on runoff yield was shown, and deposition of nutrients from the atmosphere and export from the catchment throughout the year were illustrated. A mass balance showed that there was a net export of phosphorus, but there was retention or loss of nitrogen. Expected runoff yields of nitrogen and phosphorus with variation in rainfall amount were presented. The rapid change in nutrient concentration during a runoff event was illustrated, and the doubtful reliability of export values based on isolated observations was demonstrated by the results obtained. The significance of stormwater runoff from urban areas in southern Africa as a factor in the eutrophication of impoundments was discussed. (Sims-ISWS)
W79-04565

DETERMINING NUTRIENT LOADING FROM RAINFALL AND RUNOFF IN SMALL RIVERS,
Technische Univ., Hanover (Germany, F.R.). Inst. fuer Wasserwirtschaft, Hydrologie und Landwirtschaftlichen Wasserbau.
H. R. Verworn.
Progress in Water Technology, Vol. 10, No. 5/6, p 607-617, 1978. 6 fig, 4 ref.

Descriptors: *Nutrients, *Water pollution, *Rivers, Rainfall, Runoff, Nitrogen, Ammonia, Nitrates, Phosphorus, Storm runoff, Hydrographs, Pollutants, Path of pollutants, Water pollution sources, Data processing, Analytical techniques.

Based on measurements of concentrations, rainfall, and runoff, the relations between nutrient loading and the parameters affecting it were developed. The total weight of mass was found by using a coaxial relation that connects amount and duration of rainfall, time of year, and the elapsed time since the last storm as parameters for the average concentration of the storm runoff. For determining the time distribution of the nutrient loading within the storm runoff, the Characteristic Pollutiongraph was introduced. The validity of the found relations was shown by comparing computed and measured results. (Sims-ISWS)
W79-04566

URBAN RUNOFF FROM A ROAD SURFACE--A WATER QUALITY STUDY,
Imperial Coll. of Science and Technology, London (England).
W. Pope, N. J. D. Graham, R. J. Young, and R. Perry.
Progress in Water Technology, Vol. 10, No. 5/6, p 533-543, 1978. 9 fig, 3 tab, 8 ref.

Descriptors: *Urban runoff, *Water quality, *Water pollution sources, Storm runoff, Pollutants, On-site investigations, Sampling, Chemical analysis, Analytical techniques, Hydrographs, Dissolved solids, Hydrogen ion concentration, Heavy metals, Oils, Water pollution, Path of pollutants, *England.

Preliminary results of an investigation into the quality of surface water from a motorway catchment were reported. The removal of several contaminants was studied as a first stage in the generation of a model for quantifying the environmental impact of urban runoff. Hydrological conditions were monitored routinely in three adjacent drainage systems. Automatic sampling systems were installed, and the levels of vehicle oils, specific hydrocarbons, trace metals, and solids, in runoff were estimated. Tentative correlations between contaminant concentrations and environmental conditions were proposed. (Sims-ISWS)
W79-04567

ATMOSPHERIC FALLOUT AND STREET CLEANING-EFFECTS ON URBAN STORM WATER AND SNOW,
Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Water Supply and Sewerage.
P-A. Malmquist.
Progress in Water Technology, Vol 10, No 5/6, p 495-505, 1978. 7 fig, 5 tab, 9 ref.

Descriptors: *Fallout, *Water pollution sources, *Urban runoff, Storm runoff, Snow, Snowmelt, Melt water, Suspended solids, Heavy metals, Lead, Zinc, Chemicals, Atmosphere, Pollutants, Path of pollutants, Water pollution control, Water quality, *Sweden, Street sweeping, Street cleaning.

The quality of storm water and factors governing the quality have been studied at the Urban Geohydrology Research Group at Chalmers University of Technology since 1972. In a study in Goteborg, the atmospheric fallout was found to contribute to the storm water contents of organic matter by 20%, of total phosphorus by 25%, and of total nitrogen by 70%. The heavy metal contributions from fallout ranged from 7% to 40%. Accordingly, the contents of pollutants in urban storm water may be reduced considerably by reduction of the local pollutant sources. Among these sources the corrosion of building materials and motor traffic were found. Urban snow was found to have significantly higher pollutant concentrations than average storm water from the same area. Urban snow, especially from areas with extensive land use, thus may be hazardous to the receiving waters and should be treated as sanitary sewage. The sweeping of streets may improve the quality of storm water. The sweeping of a street in the outskirts of Goteborg removed 57% of the suspended solids and between 31 and 65% of the heavy metals on the street surfaces. (Sims-ISWS)
W79-04568

THE INTERRELATIONSHIPS AMONG CHEMICAL PARAMETERS IN RIVERS--ANALYSING THE EFFECT OF NATURAL AND ANTHROPOGENIC SOURCES,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
J. S. Davis, and J. Zobrist.
Progress in Water Technology, Vol 10, No 5/6, p 65-78, 1978. 3 fig, 7 tab, 8 ref.

Descriptors: *River, *Chemicals, *Pollutants, *Water pollution sources, Analytical techniques, Watersheds(Basins), Water pollution, Sampling, Data processing, Correlation analysis, Regression analysis, Runoff, Water chemistry, *Switzerland, Factor analysis.

Estimates of the relative loading from natural and anthropogenic sources were made for various river systems. The results of three methods, linear correlations, factor analysis, and regression curve analysis based on a mathematical model, were compared. The methods used can be considered generally applicable for studies on flowing waters. Each method provides a different type of information with respect to the relative contributions to loading from (1) sources emitting a constant load (mainly anthropogenic origins), (2) sources yielding mainly a constant concentration (natural or background levels), and (3) runoff or high water flow in general. Some chemical parameters (e.g., geochemical parameters, orthophosphate, suspended solids) showed a characteristic behavior for all rivers studied. Other parameters (e.g., ammonium, total organic carbon) varied considerably between stations, thus reflecting more the characteristics of the particular drainage area and river systems. (Sims-ISWS)
W79-04569

ENHANCEMENT OF WATER-QUALITY MONITORING SYSTEMS BY INCORPORATING WATER-QUALITY MODELLING AND TIME-SERIES ANALYSIS,
Water Pollution Research Lab., Stevenage (England).
A. C. Wakeford, and G. Knowles.
Water Pollution Control, Vol 77, No 4, p 471-477, 1978. 3 fig, 29 ref, 1 append.

Descriptors: *Water quality, *Monitoring, *Mathematical models, *Time-series analysis, Rivers, Pollutants, Model studies, Dissolved oxygen, Biochemical oxygen demand, Ammonia, Nitrogen, Hydrogen ion concentration, Water pollution, Nitrates, Temperature, Water temperature.

Water quality monitoring systems such as the one developed at the Water Research Centre, England (WRC) have made it easier to gather data from rivers, so that it should now be possible to combine modelling with a monitoring system to enhance day-to-day management of river quality as well as long-term planning. Alternatively, the additional data from monitors can be treated by time-series analysis to obtain statistical relationships between, say, polluting loads and river quality, as well as to find information such as period of travel down a river. A river quality model suitable for working in conjunction with a monitoring system has been developed by the WRC. This model is already in use by some authorities for planning purposes, but in these cases the computer program representing the model is not linked in any way with data from monitors, and in fact the conditions used are pro-

jections for future conditions. In contrast, when used with monitors, the model could be placed with other programs in the minicomputer controlling a monitoring system and it would automatically make new predictions of downstream conditions whenever new data arrived from any monitor. (Sims-ISWS)
W79-04571

THE ROLE OF PLANT RESIDUES IN THE FATE OF CADMIUM IN ECOSYSTEMS. A BUFFER AGAINST CONTAMINATION OF WATER SOURCES,
Delaware Univ., Newark. School of Life and Health Sciences.
F. O. C. Ndu, D. M. Grant, and G. F. Somers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 565, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Center, University of Delaware Research Project Technical Completion Report (1978). 27 p, 6 fig, 4 tab, 7 ref. OWRT A-038-DEL(1). 14-34-0001-8008.

Descriptors: *Cadmium, Litter, *Leaching.

Cadmium was applied in simulated rain to the surface of 1m2 plots of the litter in a mixed, deciduous hardwood woodlot shortly after leaf fall, either as single applications of 250 or 1250 micrograms or as serial applications at 20-day intervals of 25 or 1250 micrograms. The litter was collected periodically, divided into new, old (partially decayed), and humus fractions and analyzed for Cd content. Samples of soil were also analyzed. The ambient Cd content of the litter was so high that only the highest dosage rates produced significant increases in Cd content. The contaminant moved very slowly through the litter over a period of 18 months. During the first five months only the new litter, that on the surface and to which the contaminant had been applied, showed significantly increased Cd content. During the second winter season this became incorporated largely into the partially decomposed fraction as a result of the additional leaf fall. An additional study with even larger amounts of Cd (5 mg/m2) confirmed the high affinity of litter, in situ, for this element. Laboratory studies using 109Cd and a pulse-chase procedure confirmed the slow movement of cadmium through litter, regardless of the fraction. Other studies in the laboratory showed that K+ and Ca++ could compete with Cd++ for the exchange sites of the litter. Extraction of the litter using standard procedures as for feed analysis virtually eliminated the affinity for Cd++.
W79-04584

CONTENTS OF TOTAL MERCURY, ALKYL MERCURY, AND METHYL MERCURY IN SOME COASTAL FISH AND SHELLS,
Yamaguchi Prefectural Research Inst. of Health (Japan).
For primary bibliographic entry see Field 5A.
W79-04589

INACTIVATION OF POLIOVIRUSES AND COXSACKIEVIRUSES IN SURFACE WATER,
New Mexico State Univ., Las Cruces. Dept. of Biology.
R. T. O'Brien, and J. S. Newman.
Applied and Environmental Microbiology, Vol. 33, No. 2, p 334-340, Feb. 1977. 2 fig, 6 tab, 18 ref. OWRT A-052-NMEX(5), 14-34-0001-7066.

Descriptors: *Microorganisms, *Water pollution, Viruses, New Mexico, Surface waters, *Water temperature, *Inactivation, *Rio Grande River, Poliovirus 1 and 3, Coxsackievirus A-13 and B-1, Infectivity, Viral ribonucleic acid.

Inactivation rates of polioviruses 1 and 3 and coxsackieviruses A-13 and B-1 were determined in situ in the Rio Grande in southern New Mexico, using membrane dialysis chambers. Inactivation of the viruses was exponential, and the rates of inactivation were apparently affected principally by the water temperature. Stability of the viruses in river water differed, with poliovirus 1 and coxsackievirus B-1 being most stable. Typically 1-log reductions of infectivity at water temperatures ranging between 23 and 27C required 25 h for poliovirus 1, 19 h for poliovirus 3, and 7 h for coxsackievirus A-13. At water temperatures of 4 to 8C, the log reduction times for poliovirus 1 and coxsackievirus B-1 were 46 and 58 h, respectively. Results obtained with labeled poliovirus 1 and coxsackievirus B-1 and with infectious ribonucleic acid indicated that inactivation was due to damage to viral ribonucleic acid. Virus-inactivation rates were also affectd by heat sterilization of river water, indicating the presence of a heat-labile or volatile inactivating factor. The inactivating factor in Rio Grande water was apparently present at a constant concentration over a 1-year period. (Stockton-NMex)
W79-04591

RADON IN POTABLE WATER SUPPLIES IN MAINE,
Maine Univ. at Orono. Land and Water Resources Inst.
C. T. Hess, E. G. Coombs, R. E. Casparius, S. A. Norton, and W. F. Brutsaert.
Maine Water Utilities Association, p 10-15, November 1978. 2 fig, 11 ref. OWRT A-045-ME(1). 14-34-0001-9021.

Descriptors: *Potable water, *Radon, Maine, Carcinogens, Radioactive isotopes, Water wells.

Ongoing studies are being done on potable water supplies in Maine in order to determine the geological sources of 222Rn in well water, to determine the rate of transfer of 222Rn into air, to determine the radiation dose due to the radioactivity of 222Rn and its daughters, and to calculate the statistical expectation of cancer and other health effects due to the influence of the radiations of 222Rn and its daughters on humans.
W79-04593

WASTE INJECTION INTO A TWO-PHASE FLOW FIELD: SAND-BOX AND HELE-SHAW MODELS STUDY,
Hawaii Univ., Honolulu. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 5E.
W79-04599

SOURCES, LEVELS, AND REACTIONS OF BORON IN FLORIDA WATERS,
Florida Univ., Gainesville. Dept. Environmental Engineering Sciences.
For primary bibliographic entry see Field 2K.
W79-04603

SIMULATION OF URBAN NON-POINT SOURCE POLLUTION,
CH2M/Hill, Redding, CA.
R. C. Sutherland, and R. H. McCuen.
Water Resources Bulletin, Vol. 14, No. 2, p 409-428, April 1978. 3 fig, 9 tab, 1 equ, 13 ref. OWRT-A-030-MD(2), 14-34-0001-8022.

Descriptors: *Simulation analysis, *Water quality control, *Computer models, *Urban pollution, *Non-point source pollution, Effects, Management, Estimating, Alternative planning, Rainfall, Accumulation, Street sweeping, Urban streets, Section 208 planning, Pollutants, Systems analysis.

Public Law 92-500 has mandated the need for evaluating the impact of non-point source pollution on receiving water quality, primarily through Section 208 Area-wide Planning. The Management of Urban Non-Point Pollution (MUNP) model was developed to estimate the accumulation of eight non-point pollutants on urban streets and their removal by both rainfall and street sweeping operations. The model can simulate: total solids or sediment-like material; volatile solids, five-day biochemical oxygen demand; chemical oxygen demand; Kjeldahl nitrogen; nitrates; phosphates; and total heavy metals. The simulated results can be used for investigation of non-point pollution management alternatives. The model is capable of reflecting variation in such diverse factors as physical and chemical characteristics of accumulated pollutants; land use, rainfall, street sweeper, and roadway characteristics; and traffic conditions. By using mean estimates of many input variables for large segments of a city, the MUNP model could be used to quickly assess the magnitude of pollutants annually entering receiving waterways due to non-point source pollution alone. If the results indicate that non-point pollution loadings are sizeable and require further analysis, the MUNP model could be used to define the specific non-point source pollution areas within a city. Hypothetical locations and actual rainfall data for Washington, D.C. have been used to demonstrate some capabilities of the MUNP model. (Bell-Cornell)
W79-04609

PHYTOPLANKTON ECOLOGY OF VANCOUVER HARBOR,
Fisheries and Marine Service, Vancouver (British Columbia). Dept. of Fisheries and Ocean.
J. G. Stockner, and D. D. Cliff.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 1, p 1-10, 1979, 7 fig, 2 tab, 38 ref.

Descriptors: *Phytoplankton, *Primary production, Chlorophyll, Nutrients, Zooplankton, Nitrates, Predation, Water pollution effects, Estuaries, *Domestic wastes, *Industrial wastes, Marine algae, Eutrophication, Vancouver Harbor, Fraser River, Burrard Inlet.

Phytoplankton production and distribution were more examined over a 2-yr period in the Burrard Inlet system, which includes a true fiord, a shallow blind inlet, and a turbulent narrows region that is contiguous to the Port of Vancouver. Greatest annual production occurred in Port Moody Arm with a mean of 532 gC.m-2.yr-1 while the lowest values were in Indian Arm and the Narrows region, averaging about 260 gC.m-2.yr-1. Nitrate and zooplankton grazing were the main factors limiting phytoplankton production in Indian Arm, while flushing and poor light conditions influenced phytoplankton growth in the Narrows and outer Burrard Inlet. Most of the discharges of domestic and industrial wastes have been diverted to the Fraser River, and Vancouver Harbor can be considered relatively clean and pollution-free because of strong tidal mixing and seaward flushing. The only sign of eutrophication in the inlet is in Port Moody Arm where sufficient nutrients from sewage discharges and a relatively stable mixed-layer depth create near optimal conditions for phytoplankton growth. Daily production here is among the highest recorded in the literature for Pacific coastal marine waters. (KATZ-EIS)
W79-04617

BEHAVIOR OF MERCURY IN BIO-SYSTEMS II. DEPURATION OF 203HG2+ IN VARIOUS TROPHIC LEVELS,
Georgia Univ., Athens. Dept. of Food Science.
M. K. Hamdy, and N. V. Prabhv.
Bulletin of Environmental Contamination and Toxicology, Vol. 19, No. 3, p 365-373, 1978. 1 fig, 1 tab, 23 ref. OWRT B-069-GA(5), 14-31-0001-3870.

Descriptors: *Mercury, *Animal physiology, Heavy metals, Bacteria, Path of pollutants, Tissue analysis, *Bioaccumulation.

Factors that influenced the biological elimination and retention of radioactively-labeled mercury were investigated. A low water temperature was found to slow rate elimination in bacterial cells. Mosquito larvae eliminated inorganic mercury at a faster rate than the organic form. The opposite was true for the bacterial cells. No difference in rate of elimination was seen in the guppy. (See also W78-01682) (EIS-Deal)
W79-04619

PHOSPHORUS LOADINGS TO LAKES AND SOME OF THEIR RESPONSES. PART 1. A NEW CALCULATION OF PHOSPHORUS

LOADING AND ITS APPLICATION TO 13 NEW YORK LAKES,
Cornell Univ., Ithaca, NY. Dept. of Natural Resources.
W. R. Schaffner, and R. T. Oglesby.
Limnology and Oceanography, Vol. 23, No. 1, p 120-134, January 1978. 2 fig, 5 tab, 64 ref. OWRT B-038-NY(3).

Descriptors: *Phosphorus, *Lakes, *Water pollution sources, Analytical techniques, Eutrophication, Water pollution effects, Finger Lakes(NY), Algae, Phytoplankton, Urban runoff, Agricultural runoff, Sewage disposal, Stratification.

Phosphorus loading to lakes should be expressed as a composite of several phosphorus forms rather than as total phosphorus, and as input to a geometric lake unit rather than surface area. Specifically, the sum of soluble reactive phosphorus, soluble unreactive phosphorus, and phosphorus potentially desorbable from particulate matter is expressed as the amount added annually to a volume equivalent to the epilimnion in stratified lakes or total lake volume in unstratified lakes. The paper also: (1) discusses procedures for estimating phosphorus contributions from various sources, especially urban and agricultural runoff; (2) presents phosphorus-loss coefficients for agricultural runoff; and (3) applies the phosphorus-loading methodology to 13 New York lakes (primarily in the Finger Lakes district). The main effect of the new method on calculation is to de-emphasize effects of agriculture and emphasize phosphorus input to shallow lakes. Lakes studied are: Conesus, Hemlock, Canadice, Honeoye, Canandaigua, Keuka, Seneca, Cayuga, Owasco, Skaneateles, Otisco, Oneida, and Canadarago. Possible sources of error in the calculations include: (1) no allowance for phosphorus losses during transit from source to lake or direct additions to streams from the terrestrial system, and (2) the assumption that no industries discharge significant phosphorus to the lakes. The calculation method appears valid for all lakes except those with mean hydraulic residence times 0.5 yr. (Lynch-Wisconsin)
W79-04621

PHOSPHORUS LOADINGS TO LAKES AND SOME OF THEIR RESPONSES. PART 2. REGRESSION MODELS OF SUMMER PHYTOPLANKTON STANDING CROPS, WINTER TOTAL P, AND TRANSPARENCY OF NEW YORK LAKES WITH KNOWN PHOSPHORUS LOADINGS,
Cornell Univ., Ithaca, NY. Dept. of Natural Resources.
R. T. Oglesby, and W. R. Schaffner.
Limnology and Oceanography, Vol. 23, No. 1, p 135-145, January 1978. 5 fig, 2 tab, 37 ref. OWRT B-038-NY(4).

Descriptors: *Phosphorus, *Lakes, *Regression analysis, *Mathematical models, *Phytoplankton, Analytical techniques, Finger Lakes(NY), Eutrophication, Model studies, Algae, Equations, Trophic level, Water management(Applied), Water pollution effects, Water pollution sources.

Using a new method of calculating phosphorus loading to lakes (presented in a companion paper) based on a composite of several phosphorus forms rather than on total phosphorus, and as input to the summer mixed zone rather than surface area, this study examines responses of 16 lakes in central New York State to such loading as an interrelated series of simple regression models. Regressions describing dependence of summer phytoplankton standing crop and winter total phosphorus concentration on loading and of standing crop on total phosphorus are linear. Those characterizing water transparency as a function of standing crop and winter total phosphorus are parabolic. All regressions showed high correlation coefficients. The overall model comprising these regressions supports the hypothesis that lake phosphorus loading is an important factor controlling phytoplankton standing crop. The regressions are useful for trophic state description and in developing lake management strategies. The revised phosphorus loading calculation method incorporates the sum of soluble reactive and unreactive phosphorus, and phosphorus potentially desorbable from particulate matter. The lakes studied represent a wide range of morphology, hydrology, and phosphorus loading. The methodology presented is valid for all lakes with mean hydraulic retention time > 0.5 yr. It is noted that with very high loadings, phoshorus may no longer control phytoplankton production. (Lynch-Wisconsin)
W79-04622

INPUT FOR A STOCHASTIC CONTROL MODEL OF P LOADING,
Banyaszati Kutato Intezet, Budapest (Hungary).
I. Bogardi, and L. Duckstein.
Ecological Modelling, Vol. 4, No. 2-3, p 173-195, 1978. 3 fig, 1 tab, 72 ref. OWRT B-043-ARIZ(28).

Descriptors: Trophic level, *Phosphorus, *Lakes, *Mathematical models, Lake Balaton(Hungary), Planning, *Agricultural runoff, Nutrients, Nonpoint pollution, Model studies.

A stochastic model for estimating phosphorus loading from nonpoint sources of pollution, is illustrated by Lake Balaton, Hungary. Preliminary practical results are given for Lake Balaton's Tetves subwatershed. Uncertainty in phosphorus loading is described in two categories for eutrophication control: (1) phosphorus dissolved in runoff, and (2) phosphorus fixed or sorbed by sediments. The model defines hydrologic events as follows: Rainfall triggers phosphorus transport from a source such as agricultural fertilizers, resulting in runoff volume V and sediment yield Z. Rainfall events are characterized by amount X1, duration X2, and interarrival time T. The amount of dissolved phosphorus transported is estimated by multiplying dissolved phosphorus concentration (C1) by runoff volume, and the amount of sorbed phosphorus by multiplication of the concentration of phosphorus fixed to sediments (C2) by sediment yield per event. Sediment yield is calculated with the Universal Soil Loss Equation, and peak flow and runoff volume with U.S. Soil Conservation Service empirical formulas. Total seasonal loading is calculated as the sum of a random number of random phosphorus-loading events. The model permits estimation of long-run phosphorus accumulation in sediments, important for a eutrophication control model. As considerable phosphorus loading uncertainty is indicated for Lake Balaton, use of a stochastic model seems appropriate. (Lynch-Wisconsin)
W79-04623

THE INFAUNAL BENTHOS OF A NATURAL OIL SEEP IN THE SANTA BARBARA CHANNEL,
California Univ., Livermore. Lawrence Livermore Lab.
R. B. Spies, and P. H. Davis.
Marine Biology, Vol. 50, p 227-237, 1979. 6 fig, 5 tab, 50 ref.

Descriptors: *Oil, *Toxicity, *Benthic fauna, Biological communities, Aquatic populations, Oligochaetes, Oil pollution, Organic compounds, Statistical methods, Adaptation, Methane, Aromatic compounds, Bottom sediments, Chemical analysis, *Diversity, *Diversity indices, *Polychaetes, *Bioaccumulation.

A diverse infaunal benthic community that exists in the fine sand sediments of a shallow natural oil seep near Santa Barbara, California was studied. The study area and sampling methods are described in this introductory paper. Data presented indicate the adequacy of sampling in revealing horizontal patchiness and vertical faunal distributions. The infauna of the seep and of a nearby comparison area, without seepage but of similar depth and sediment type, are compared. The data indicate a consistently larger but fluctuating density of organisms at the seep station. However, Shannon-Weaver diversity, Peilou's evenness, and measures of dominance-diversity with estimates of graphical skewness and kurtosis are all similar for the two stations. The rank correlation of common species at the stations is significant according to Spearman's rho. Species common to both stations account for 85 to 95% of the individuals, further indicating the high degree of similarity between stations. Denser populations of oligochaetes and the maldanid polychaete Praxillella affinis pacifica suggest some advantages for deposit feeders at the seep station. Mats of the bacterium Beggiatoa sp. are associated with localized intense oil seepage. Hypotheses suggesting trophic enrichment and biochemical adaptation at the seep are presented. (Deal-EIS)
W79-04624

EFFECT OF ENRICHMENT WITH DIGESTED NIGHT SOIL ON THE GROWTH OF MARINE PLANKTON (IN JAPANESE),
Yamanashi Univ., Kofu (Japan). Dept. of Environmental Engineering.
O. Nakayama, M. Ohno, and T. Yasui.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 44, No. 10, p 1099-1103, 1978. 6 fig, 3 tab, 11 ref. (English abstract).

Descriptors: *Aquatic algae, *Sewage, *Phytoplankton, *Primary productivity, *Organic wastes, *Sewage disposal, Fertilization, Domestic wastes, Growth rates, Laboratory tests, On site investigations, Diatoms, Marine algae, Cyanophyta, Aquatic plants, Nitrogen cycle, Chlamydomanas, Chlorophyll, Phosphates, *Nitzschia.

Enhancement of algal growth and accompanied organisms after fertilization with night soil digested by facultatively anaerobic process was estimated through indoor and outdoor experiments. Seawater enriched with various amounts of digested night soil was inoculated with Nitzschia closterium or mixed population of natural phytoplankton. Growth of Nitzschia and natural plankton especially green flagellates was stimulated by adding 5-20 ml/l and 5 ml/l of night soil, respectively. A floating box made of PVC filled with 100 l of natural seawater enriched with 1 liter of digested night soil was placed on the water surface of Uranouchi-Bay, Pacific coast of Kochi prefecture, Japan. Water temperature was about 13C. Population of plankton and soluble trophic elements were surveyed every week for 4 weeks. Planktonic diatoms, which dominated in the original seawater, were overcome by such unicellular green algae as Platymonas and Chlamydomonas. Some filamentous and coccoid blue-greens and ciliates also propagated. Content of chlorophyll a increased from 2.5 to 43 micrograms/l and soluble phosphates decreased from 10 to 0.5 micrograms/l after 4 weeks. (Katz-EIS)
W79-04626

MATHEMATICAL MODELING OF PESTICIDES IN THE ENVIRONMENT,
Environmental Research Lab., Athens, GA.
J. Hill, IV.
In: Symposium on Environmental Transport and Transformation of Pesticides, October, 1976, Tbilis, USSR. EPA-600/9-78-003, p 194-197. February, 1978, 24 ref.

Descriptors: *Pesticide toxicity, *Mathematical models, Model studies, Path of pollutants.

This paper recommends that research needs to be directed toward mathematical modeling that allows translation of laboratory measurements of pesticide effects on growth, physiology, and environmental interaction to field conditions. Further, it suggests that models need to be developed that estimate whole system behavior based upon data representing a limited set of component interactions. Hierarchial models with constrained subsystems and homomorphic structures derived from influence analysis may accomplish these goals in the near future. (Skogerboe-Colorado State)
W79-04648

BASIC MATHEMATICAL MODELS OF TOXICANT TRANSPORT THROUGH THE SOIL PROFILE,
Moskovskaya Selskokhozyaistvennaya Akademiya (USSR).

V. V. Rachinskii.
In: Symposium on Environmental Transport and Transformation of Pesticides, October, 1976, Tbilis, USSR. EPA-600/9-78-003, p 201-209, February, 1978. 5 ref.

Descriptors: *Pesticide kinetics, Sorption, Dynamics, *Mathematical models, Chromatography, *Path of pollutants.

Basic mathematical models of toxicant transport through the soil profile are discussed. Mathematical expressions are developed for the sorption dynamics problems using the kinetic parameter of time lag and at a variable velocity of the mobile phase. (Skogerboe-Colorado State)
W79-04649

RESPONSE OF EURYTHERMAL AND STENOTHERMAL FISH SPECIES TO CHLORINATED DISCHARGES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology; and Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
D. S. Cherry, S. R. Larrick, K. L. Dickson, and J. Cairns, Jr.
In: Trace Substances in Environmental Health - XI, p 413-418, 1977. D. D. Hemphill, Ed. University of Missouri, Columbia. 1 fig, 2 tab, 18 ref.

Descriptors: *Chlorine, *Toxicity, *Water temperature, Coho salmon, Rock bass, Bass, Fish behavior, Fish physiology, Chlorination, Control, Biocontrol, Electric powerplants, Fouling, *Hypochlorous acid, *Biocides.

The impact of some steam-electric power production discharges, such as chlorine, upon the response of fish populatins in receiving waters has not been sufficiently investigated to establish scientifically justifiable standards. Two eurythermal fish species, smallmouth bass and rockbass, and stenothermal coho salmon were exposed to serveral 'doubling' conentrations of total residual chlorine (TRC) from 0.025, 0.05. . .0.80 mg/l in a field laboratory located at a power plant. Avoidance responses were tested at acclimation temperatures from 6, 12. . .30C at 6C increments or until the lethal temp was reached. The first significant avoidance to TRC increased with an increase in acclimation temp. The first avoidance increased from 0.05 to 0.20 mg/l TRC for smallmouth bass tested at 6-30C, while coho salmon avoided concentrations from 0.05-0.10 mg/l when tested at 6-18C. Rockbass failed to avoid any chlorinated dose, regardless of the acclimation temp. After the first avoidance, both species showed less avoidance or attraction to higher concentrations of TRC. The avoidance response appeared to be influenced more by the interaction of pH and temp upon the dissociation of hypochlorous acid (HOCl) that comprised the TRC. (DEAL-EIS)
W79-04651

HEXACHLOROCYCLOHEXANE, METAPHOS, AND CHLOROPHOS DECOMPOSITION IN SOIL AND THEIR MIGRATION WITH THE WATERS OF SURFACE RUNOFF,
Hydrochemical Inst., Novocherkassk (USSR).
M. N. Tarasov, L. G. Korotova, A. S. Demchenko, and L. V. Brazhnikova.
In: Symposium on Environmental Transport and Transformation of Pesticides, October, 1976, Tbilis, USSR. EPA-600/9-78-003, p 108-116, February, 1978, 3 fig, 2 tab.

Descriptors: Pesticide removal, *Pesticide kinetics, Runoff, *Path of pollutants, Hexachlorocyclohexane, Metaphos, Chlorophos, Pesticide residues, Decomposition.

Great quantities of chemicals and among them pesticides, enter the biosphere due to intensive chemicalization of agriculture. Upon the influence of different factors intensive chemicalization of agriculture. Upon the influence of different factors the greater part of pesticides is decomposed in soil forming primary products and certain preparations are preserved in soil for a long time due to high persistency. Systematic usage of persistent pesticides and those with high cumulative properties at vast watersheds occupied by agricultural lands may result in pollution of natural waters. In order to predict of natural bodies by pesticides, it is necessary to study the rate of their decomposition in different soils, migration capability was well as to obtain quantitative characteristics of their removal from agricultural lands. This paper reports the results obtained from studies of hexachlorocyclohexane (BHC), metaphors, and chlorophors decomposition in soil, thier migration capability as well as the possiblity of washing out by surface runoff. (Skogerboe-Colorado State)
W79-04654

ESTIMATION OF ORGANOCHLORINE PESTICIDE LOSS IN SURFACE RUNOFF WATERS,
Institute of Experimental Meteorology, Obninsk (USSR).
Ts. I. Bobovnikova, E. P. Virchenko, G. K. Morozova, Z. A. Sinitsyna, and Yu. P. Cherkhanov.
In: Symposium on Environmental Transport and Transformation of Pesticides, October, 1976, Tbilis, USSR. EPA-600/9-78-003, p 103-107, February, 1978. 1 ref.

Descriptors: Pesticide removal, *Pesticides, Runoff, Water pollution sources, *Path of pollutants, *Organochlorine pesticides, DDT, BHC.

Pesticide migration in water is one of the major pathways of their transport in the environment. Surface runoff water which occurs at the watershed as the result of snowmelt or rainfall causes pesticide removal from the watershed area (agricultural lands and forests) and their entering rivers and basins. Investigations in Russia showed that surface runoff from the watershed was the major source of river water pollution with pesticides. The experimental results obtained show that the loss coefficients of organochlorine pesticides--DDT and gamma-BHC--were low both at the natural waterhseds and at the experimental runoff plots (tenth and hundredth fractions of percent). The gamma-BHC loss coefficient did not exceed 3.7% even when gamma-BHC was applied in the snow cover before the snowmelt, that is under the best runoff conditions. (Skogerboe-Colorado State)
W79-04655

TRANSFORMATION AND TRANSPORT PROCESSES IN AQUATIC SYSTEMS,
Environmental Research Lab., Athens, GA.
G. L. Baughman.
In: Symposium on Environmental Transport and Transformation of Pesticides, October, 1976, Tbilis, USSR. EPA-600/9-78-003, p 98-102, February, 1978. 25 ref, 1 equ.

Descriptors: *Pesticide kinetics, Pesticide removal, Aquatic environment, Chemical degradation, Water pollution control, Volatility.

Dynamics of transformation and transport are described in terms of their controlling environmental parameters. Recent advances in ability to mathematically describe the rate and extent of microbiological, chemical, and physical processes are discussed and data are presented to illustrate interrelationships between these processes. (Skogerboe-Colorado State)
W79-04656

COMETABOLISM OF FOREIGN COMPOUNDS,
Akademiya Nauk SSSR, Pushchino. Inst. of Biochemistry and Physiology of Microorganisms.
L. A. Golovleva, and G. K. Skryabin.
In: Symposium on Environmental Transport and Transformation of Pesticides, October, 1976, Tbilis, USSR. EPA-600/9-78-003, p 73-85, February, 1978, 6 fig, 11 ref.

Descriptors: *Microbial degradation, *Soil microbiology, Microorganism, Soil microorganism, Herbicides, Chemical degradation, Path of pollutants, Pesticide residues.

The fermentative conversions of many organic substances are closely connected or even depend on oxidation of other compounds--cosubstrates. This dependence is generally called cometabolism. The best known are the cometabolism processes of foreign compound--xenobiotics, though there are also the examples of cometabolism of natural compounds for instance steroids and terpenses as well as such substrates as xylose, widely spread in nature and easily metabolized. The investigations conducted by the authors proved that conversions of many xenobiotics are possible only under cometabolism conditions. the experiments with introduction of microorganisms into natural water reservoirs did not give positive results. However, the degradation of herbicides was significantly accelerated after introducing cosubrates. So, analysis of 2,4-D dynamics in waste waters of rice fields has shown that 2,4-D disappeared more quickly if propionate was used as cosubstrate. In this case the herbicide was not detected in the water in 3 days, at the same time about 25% of initial 2,4-D was present in control experiments (without propionate). (Skogerboe-Colorado State)
W79-04658

PESTICIDE TRANSPORT AND METABOLISM IN MODEL SYSTEMS,
Agricultural Research Service, Beltsville, MD. Pesticide Degradation Lab.
D. D. Kaufman, P. C. Kearney, and R. G. Nash.
In: Symposium on Environmental Transport and Transformation of Pesticides, October, 1976, Tbilis, USSR. EPA-600/9-78-003, February, p. 61-72. 1978, 6 fig, 2 tab, 14 ref.

Descriptors: Pesticide kinetics, *Pesticide residues, Soil leaching, Assay, Soil microbiology, Microbial degradation, Sorption, Laboratory tests, *Path of pollutants.

Laboratory studies devoted to investigating the environmental fate of pesticides have usually examined individual processes such as microbial metabolism, soil leaching, surface and vapor phase photodecomposition, volatilization from plant or soil surfaces, and plant uptake. In the environment, however, all of these processes may be operative on the molecule, so that in each stage of the pesticide dissipation process, one or more processes may play a major role. It has been extremely difficult to study two or more of these processes under controlled conditions which will enable a clear understanding of the contribution of each. Simplified model laboratory systems are now being developed which enable simultaneously measurement of numerous factors affecting pesticide dissipation in the environment. This paper is a discussion of a few model laboratory systems. (Skogerboe-Colorado State)
W79-04661

HYDROLYTIC AND PHOTOCHEMICAL DEGRADATION OF ORGANOPHOSPHORUS PESTICIDES,
Arkansas Univ., Fayetteville. Dept. of Chemistry.
J. F. Hinton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 705, Price codes: A05 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center University of Arkansas, Report 1978. 72 p, 11 fig, 14 tab, 63 ref. OWRT A-030-ARK(1). 14-34-0001-6004.

Descriptors: *Organophosphorus pesticides, *Pesticides, *Pesticide kinetics, *Degradation, Decomposition, Testing, Equations, Chemical analysis, Water pollution sources, Water pollution, Path of pollutants, Soil contamination.

Research is presented to provide qualitative and quantitative information on the stability of organophosphorus pesticides, their degradation time, their modes of degradation, and the effects of sunlight, temperature, additional chemicals, and environmentally native substances on the rates and path-

ways of decomposition. Ethyl parathion, methyl parathion, and supracide were studied using 31P nmr as the main instrumental technique. Representative chemical shift ranges of the various types of organophosphorus compounds are tabulated. Solvent concentration was greater than pesticide concentrations, so that pseudo-first-order kinetics were assumed and described by a rate equation. An arrhenius plot showing the degradation of the selected pesticides is included. Ethyl parathion degraded slower than the other pesticides at all temperatures studied because methyl esters undergo dealkylation more readily than ethyl esters. Values of 18 to 20 kcal mole-1 were found for phosphorothionate parathion pesticides. (Davison-IPA)
W79-04682

AN AUTOMATED DEVICE (AGARS) FOR STUDYING AVOIDANCE OF POLLUTANT GRADIENTS BY AQUATIC ORGANISMS,
University of West Florida, Pensacola. Faculty of Biology.
For primary bibliographic entry see Field 5A.
W79-04696

QUALITY ASPECTS OF AGRICULTURAL RUNOFF AND DRAINAGE.
American Society of Civil Engineers, New York. Task Committee on Agricultural Runoff and Drainage of the Water Quality.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol. 103, No. IR4, p 475-495, December 1977. 4 tab, 67 ref.

Descriptors: *Agriculture, *Eutrophication, *Drainage, *Runoff, *Sedimentation, *Federal laws, Water management(Applied), Water pollution, Water quality, Plant nutrition, Pesticides.

The ASCE Task Committee on Agricultural Runoff and Drainage has summarized the literature and research findings with respect to sources of pollutants, nature of downstream impacts, and relationships between pollutant loads and certain physical variables. Agricultural discharges from nonirrigated lands are significant contributors of nitrogen, phosphorus, and pesticides to downstream receiving waters. State-of-the-art knowledge indicates that management practices directed toward control of erosion, control of runoff, and management of fertilizer and pesticide application can reduce total pollutant load carried off-site from agricultural lands. The development of on-site discharge water quality control measures, as contemplated under PL 92-500, must be predicated on detailed surveys of a more specific nature due to the high degree of variability in the factors influencing waterborne pollutant transport. (Bell-Graf--Cornell)
W79-04710

A MATHEMATICAL DETERMINISTIC RIVER-QUALITY MODEL. PART I: FORMULATION AND DESCRIPTION,
Water Pollution Research Lab., Stevenage (England).
G. Knowles, and A. C. Wakeford.
Water Research, Vol. 12, No. 12, p 1149-1153, 1978. 1 fig, 5 ref, 2 append.

Descriptors: *Water quality, *Rivers, *Mathematical models, *Forecasting, Model studies, Computer models, Biochemical oxygen demand, Nitrification, Chemical reactions, Denitrification, Photosynthesis, Reaeration, Dissolved oxygen, Equations, Foreign research, River quality model.

A comprehensive river water quality model, deterministic in type, is described in Part 1, and its application to a river catchment is given in Part 2. The 11 processes represented in the model included nitrification, denitrification, photosynthesis, as well as the numerical integration employed. A choice of FORTRAN computer programs is available, each embodying the model--one being for 'interactive' use from a computer terminal, one for conventional 'batch' use at any computer center; while a third form is envisaged for incorporation in a minicomputer or microprocessor controlling remote automatic water quality monitoring stations. This third form would allow predictions of downstream quality immediately data are received from each station, so enabling early warning of impending substandard conditions. An appendix enumerated the processes modelled and the equations used. (See also W79-04722) (Humphreys-ISWS)
W79-04721

A MATHEMATICAL DETERMINISTIC RIVER-QUALITY MODEL. PART 2: USE IN EVALUATING THE WATER-QUALITY MANAGEMENT OF THE BLACKWATER CATCHMENT,
Thames Water Authority, Reading (England).
P. Casapieri, T. M. Fox, P. Owers, and G. D. Thomson.
Water Research, Vol. 12, No. 12, p 1155-1161, 1978. 5 fig, 2 tab, 1 ref.

Descriptors: *Water quality, *Rivers, *Mathematical models, *Management, On-site investigations, Watersheds(Basins), Model studies, Biochemical oxygen demand, Dissolved oxygen, Nitrates, Ammonia, Foreign research, *England, *Blackwater River(England), River quality model.

A deterministic river-quality model was used to predict river qualities in the Blackwater System (part of the River Thames catchment). The model was tested under the relatively dry conditions of 1973 and more normal conditions of 1974. It was concluded that satisfactory agreement between predicted and observed data was obtained. On this basis, the use of the model was extended to simulate conditions for 1981 and 1991 in an attempt to evaluate what the effect on the river quality would be if certain capital works programs were or were not proceeded with. It was demonstrated that with the potential expansion in this catchment area, the quality of the Blackwater would not improve unless capital works programs are carried out. (See also W79-04721) (Humphreys-ISWS)
W79-04722

TRANSPORT OF NUTRIENTS AND CARBON FROM THE NANAIMO RIVER TO ITS ESTUARY,
Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station.
For primary bibliographic entry see Field 2L.
W79-04726

FACTORS CONTROLLING THE ESTUARINE CHEMISTRY OF ARSENIC,
Skidaway Inst. of Oceanography, Savannah, GA.
For primary bibliographic entry see Field 2L.
W79-04728

EFFECT OF SALT UPON HOT-WATER DISPERSION IN WELL-MIXED ESTUARIES,
Cambridge Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.
For primary bibliographic entry see Field 2L.
W79-04729

THREE-DIMENSIONAL TEMPERATURE MODEL FOR SHALLOW LAKES,
Johns Hopkins Univ., Laurel, MD. Applied Physics Lab.
J. C. Uzzell, Jr., and M. N. Ozisik.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY12, Proceedings Paper 14256, p 1635-1645, December 1978. 6 fig, 10 ref, 3 append.

Descriptors: *Water temperature, *Distribution patterns, *Thermal pollution, *Lakes, *Model studies, Mathematical models, Numerical analysis, Water pollution, Powerplants, Thermal water, Cooling water, Temperature, Temporal distribution, Equations, Dispersion.

A pseudo three-dimensional, time-dependent analytical model was developed for the prediction of temperature distribution in lakes resulting from thermal discharges. For the special case of lakes having a uniform depth, rectangular geometry, and a constant axial velocity, explicit analytical solutions were presented. Sample calculations were performed to demonstrate the effects of the time variation of the thermal loading, different types of boundary conditions, circulation velocities, and eddy conductivity coefficients on the surface temperature distribution along the lake as a function of time. (Sims-ISWS)
W79-04731

TEMPORAL MOMENTS FOR LONGITUDINAL DISPERSION,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
Y. H. Tsai, and E. R. Holley.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY12, Proceedings Paper 14266, p 1617-1634, December 1978. 12 fig, 1 tab, 19 ref, 2 append. NSF ENG76-11220.

Descriptors: *Dispersion, *Diffusion, *Channel flow, *Model studies, Mathematical models, Numerical analysis, Open channels, Solutes, Pollutants, Path of pollutants, Water pollution, Distribution patterns, Temporal distribution, Spatial distribution, Tracers, Dye releases, Velocity, Flow, Mixing, Advection.

Aris' moment transformation was used to convert the advective-diffusion equation for two-dimensional (longitudinal and transverse) open channel flow into temporal moment equations. The equation for the zeroth temporal moment of the concentration distribution includes the initial concentration distribution, which is a Dirac delta function for instantaneous injections. This equation can be solved analytically for some specific velocity distributions, but it cannot be solved numerically because of the delta function. Using an implicit finite difference scheme, numerical solutions for both spatial and temporal moments were obtained for plane and centered line source initial conditions and for three velocity distributions. The results were used to examine the relationship between the special and temporal moments during both the initial period and the dispersive period. (Sims-ISWS)
W79-04732

FACTORS AFFECTING THE EXPORT OF NITRATE-NITROGEN FROM DRAINAGE BASINS IN SOUTHERN ONTARIO,
York Univ., Toronto (Ontario). Dept. of Geography.
A. R. Hill.
Water Research, Vol. 12, No. 12, p 1045-1057, 1978. 7 fig, 4 tab, 30 ref.

Descriptors: *Watersheds(Basins), *Water quality, *Water pollution sources, *Runoff, Nitrates, Nitrogen, Agricultural watersheds, Streams, On-site investigations, On-site data collections, Evaluation, Analytical techniques, Discharge(Water), Streamflow, Water pollution.

The export of nitrate-N from 21 watersheds near Toronto, Ontario, was measured over a 25-month period. The annual average loss ranges from 1.41 to 7.31 kg/ha. Analysis of these data indicated a very significant correlation between nitrate exports and percentage of each watershed in crops and abandoned agricultural land. A number of soil and topographic variables also had significant correlations with stream nitrate levels. The causal relationships underlying these simple correlations are difficult to evaluate because of considerable multicollinearity between land use and watershed physiography. The separate analysis of stream discharge indicated that agricultural watersheds have lower mean annual discharges (l/sec/(sq km) than those watersheds containing extensive areas of forest and abandoned agricultural land. Variations in annual discharge, therefore, tended to reduce the contrast in nitrate exports between agricultural and non-agricultural watersheds. The influence of watershed characteristics on nitrate levels exhibited considerable seasonal contrasts. During summer

low flow conditions, nitrate concentration and loss were not correlated with watershed land use; instead they were affected primarily by localized pollution sources and by biological processes within the streams. (Humphreys-ISWS)
W79-04735

ANALYSES OF WATER, CORE MATERIAL, AND ELUTRIATE SAMPLES COLLECTED NEAR YAZOO CITY, MISSISSIPPI, (YAZOO HEADWATER PROJECT),
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 1B.
W79-04793

SELECTED WATER-QUALITY DATA FROM THE MERCED RIVER, CALIFORNIA, NOVEMBER 1976 THROUGH AUGUST 1977,
Geological Survey, Menlo Park, CA. Water Resources Div.
R. J. Hoffman.
Available from OFSS USGS Box 25425, Fed. Ctr. Denver CO 80225. Paper copy $8.25, microfiche $3.50. Geological Survey open-file report 78-735, September 1978. 53 p, 1 fig, 11 tab, 6 ref.

Descriptors: *Water quality, *Water pollution, *Water analysis, *Chemical properties, *Physical properties, Chemical analysis, Surface waters, Federal Water Pollution Control Act, National parks, California, *Merced River, *Yosemite National Park, Lake McClure, Merced Lake, Washburn Lake.

The Merced River originates on the western slope of the Sierra Nevada and flows through Yosemite National Park. The river drains 1,276 square miles before joining the San Joaquin River near Stevinson, Calif. Data were collected from November 1976 through August 1977 to permit a description of the river's quality during a hydrologic cycle, the natural and manmade factors in the basin that affect the quality, and the trends that can be used to reduce degradation in the future. (Woodard-USGS)
W79-04794

A COMPUTER PROGRAM FOR SIMULATING SALINITY LOADS IN STREAMS,
Geological Survey, Cheyenne, WY. Water Resources Div.
K. C. Glover.
Geological Survey open-file report 78-884, November 1978. 31 p, 2 fig, 7 tab, 3 ref.

Descriptors: *Computer programs, *Salinity, *Movement, *Streams, *Analytical techniques, Path of pollutants, Water quality, *Salinity transport, *Chemical loads.

A FORTRAN IV program that simulates salinity loads in streams is described. Daily values of stream-discharge in cubic feet per second, or stream-discharge and specific conductance in micromhos, are used to estimate daily loads in tons by one of five available methods. The loads are then summarized by computing either total and mean monthly loads or various statistics for each calendar day. Results are output in tabular and, if requested, punch card format. Under selection of appropriate methods for estimating and summarizing daily loads is provided through the coding of program control cards. The program is designed to interface directly with data retrieved from the U.S. Geological Survey WATSTORE Daily Values File. (Woodard-USGS)
W79-04800

CHEMICAL ANALYSES OF WATER FROM THE MINNELUSA FORMATION AND EQUIVALENTS IN THE POWDER RIVER BASIN AND ADJACENT AREAS, NORTHEASTERN WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
D. K. Wells, J. F. Busby, and K. C. Glover.
Wyoming Water Planning Program Report No 18, January 1979. 27 p, 1 fig, 2 tab, 5 ref.

Descriptors: *Water quality, *Chemical analysis, *Water wells, *Springs, *Drill holes, Oil, Exploration, Water analysis, Water utilization, Well data, Groundwater availability, Wyoming, *Powder River basin, *Minnelusa Formation.

Data are presented for 46 water wells, 5 springs, and 373 oil and gas test holes penetrating rocks of Lower Permian and Upper Pennsylvanian age in the Powder River structural basin and adjacent areas in Wyoming. A table states water-quality criteria with recommended limits and another table lists well locations, depths, and chemical constituents. A map showing locations of sample points also is included. (Woodard-USGS)
W79-04807

ASSESSMENT TECHNIQUES FOR MODELING WATER QUALITY IN A RIVER BASIN AFFECTED BY COAL-RESOURCE DEVELOPMENT,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-04808

COMPUTER MODEL OF TWO-DIMENSIONAL SOLUTE TRANSPORT AND DISPERSION IN GROUND WATER,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-04813

ENTRAINMENT OF LARVAL FISH BY THE DOUGLAS POINT GENERATING STATION, LAKE HURON, IN RELATION TO SEASONAL SUCCESSION AND DISTRIBUTION,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 5C.
W79-04816

THE EFFECTS OF SOME POLLUTANTS ON THE SURVIVAL, GROWTH AND RESPIRATION OF LAMINARIA HYPERBOREA,
Liverpool Univ. (England). Dept. of Marine Biology.
For primary bibliographic entry see Field 5C.
W79-04834

TOXIC EFFECTS OF ZINC ON FATHEAD MINNOWS PIMEPHALES PROMELAS IN SOFT WATER,
Environmental Research Lab., Duluth, MN.
For primary bibliographic entry see Field 5C.
W79-04837

TRACE METALS IN THE COMMON MUSSEL, MYTILUS EDULIS (L.), AND IN THE ALGA FUCUS VESICULOSUS (L.) FROM THE REGION OF THE SOUND (ORESUND),
Uppsala Univ. (Sweden). Dept. of Zoology.
D. J. H. Phillips.
Environmental Pollution, Vol. 18, p. 31-43, 1979. 5 fig, 2 tab, 29 ref.

Descriptors: *Mussels, *Aquatic algae, *Heavy metals, Zinc, Cadmium, Lead, Iron, Path of pollutants, Animal metabolism, Animal physiology, Plant physiology, Water chemistry, Chemical analysis, Trace elements, Phytoplankton, *Tissue analysis, *Mytilus, *Fucus, Oresund, Sweden, Norway.

Concentrations of zinc, cadmium, lead and iron were determined in whole soft parts of mussels, Mytilus edulis, and in growing tips of the alga Fucus vesiculosus from a total of 20 locations in the area of the Sound between Sweden and Denmark. Pollution profiles produced for each metal were similar in any one of the species studied but the profiles for metals in M. edulis were distinct from those for metals in F. vesiculosus. Results for mussels agreed broadly with those reported previously for this region, indicating a northward decrease in available metal concentrations. By contrast, results for algae showed few differences in metal availability throughout the study area, although some local effects were evident. The differences in the pollution profiles exhibited by these two organisms depend on their response to different portions of the total trace metal load of ambient waters. Results from the alga agree well with available data on the concentrations of trace metals in solution in waters of the Sound. The alga thus appears to be responding only to metals in solution, as suggested by previous authors. By contrast, the major proportion of the total body load of metals in mussels is derived from ingested phytoplankton. Possible mechanisms for the production of such differences in the metal contents of the two phytoplankton populations, and the ecological implications of these differences, are briefly discussed. (Deal-EIS)
W79-04840

EDIBLE-OIL POLLUTION ON FANNING ISLAND,
Hawaii, Univ., Honolulu. Dept. of Botany.
D. J. Russell, and B. A. Carlson.
Pacific Science, Vol. 32, No. 1, p 1-15, 1978. 7 fig, 6 tab, 31 ref.

Descriptors: *Oil spills, *Oily water, *Fish kill, *Mortality, Reefs, *Pollutants, Organic matter, Water pollution effects, Water pollution sources, Water pollution, Algae, Biological communities, On-site investigation, Cladophora, Crustaceans, Mollusks, Succession, *Edible oil pollution, Vegetable oils, *Fanning Island, *Enteromorpha, *Ulva, Coconut.

In August 1975 the M. V. Lindenbank went aground on Fanning Atoll and dumped 17,797 metric tons of cargo onto a pristine coral reef. Nearly 10,000 tons of the cargo were vegetable oils and edible-oil raw materials such as copra. Although no toxic substances were dumped into the water, the effects of these oily substances were similar to those occurring after a petroleum oil spill. Fishes, crustaceans, and mollusks were killed and an excessive growth of Enteromorpha and Ulva occurred. The animal kill was most likely attributable to asphyxiation and clogging of the digestive tract, while the algal growth was most likely attributable to the elimination of algal competitors, increased fertilization from the pollution and ship, and reduced grazing pressure. Oil may have suppressed certain algal species while stimulating others. Complete recovery of the original coralline algal community proceeded in sequence from Enteromorpha to Ulva to Cladophora-Lyngbya to Hypnea-Caulerpa to Jania-Gelidium. The climax community became evident 11 months after the original spill. (Katz-EIS)
W79-04841

THE EFFECTS OF HEATED EFFLUENTS ON THE PRODUCTION OF MARINE PLANKTON (TAKAHAMA NUCLEAR POWER STATION-I) (IN JAPANESE),
Seikai Regional Fisheries Research Lab., Nagasake (Japan).
M. Anraku, and E. Kozasa.
Bulletin of Plankton Society of Japan, Vol. 25, No. 2, p 93-110, 1978. 11 fig, 5 tab, 14 ref. (English abstract).

Descriptors: *Water temperature, *Zooplankton, *Phytoplankton, *Effluents, *Nuclear powerplants, Marine microorganisms, Aquatic microorganisms, Primary productivity, Water temperature, Heated water, Environmental effects, Thermal pollution, Chlorophyll, Aeration, On-site investigations, Spatial distribution, Heated effluents, ATP.

The effects of heated effluents from Takahama Nuclear Power Station during two five day periods resulted in a reduction of chlorophyll a and ATP in the effluent canal relative to the intake canal. Laboratory experiments with artificial temperature rise and strong aeration produced similar results. The effluent contained a considerable re-

duction in zooplankton as measured by ATP. Laboratory experiments with artificial temperature rise and strong aeration revealed some increase of ATP at 30C and intense decrease at 40C. The reason for this rise has not yet been examined. The results of vital staining confirmed the presence of dead zooplankton, up to 30-40% in the innermost bay in front of the opening of the effluent canal. Reductions in phytoplankton and zooplankton populations seemed to be caused by complex physical and chemical effects resulting from passage through the condenser as well as by the temperature rise. (Katz-EIS)
W79-04842

POLLUTION OF A WATER SUPPLY CATCHMENT BY BREEDING GULLS AND THE POTENTIAL ENVIRONMENTAL HEALTH IMPLICATIONS,
North West Water Authority (England).
F. Jones, P. Smith, and D. C. Watson.
Journal of the Institution of Water Engineers and Scientists, Vol. 32, No. 6, p 469-482, November 1978. 3 fig, 5 tab, 12 ref.

Descriptors: *Water pollution sources, *Watersheds(Basins), *Gulls, *Pollutants, Birds, Water pollution, Water supply, Sampling, On-site investigations, E. coli, Coliforms, Salmonella, Laboratory tests, Data collections, Bacteria, Foreign research, *England.

Routine bacteriological sampling of a distributed potable water supply in 1975 drew attention to the pollution of a water catchment area by the activities of a large colony of breeding gulls. Increased chlorination, additional safety barriers, and improved monitoring resulted in highly improved bacteriological standards of potable water. Investigations were undertaken to enumerate E. coli and to isolate and identify Salmonellae in the raw water. The salmonella serotypes identified correlated well with those isolated from cases of food poisoning reported during the following weeks in the local human population. During the following gull breeding season, a more intensive study was carried out, but the workload limited examination for salmonellae to a qualitative basis. Results confirmed the high levels of microbial pollution on the breeding grounds and in the raw waters. A total of 19 different serotypes of salmonellae were isolated. Little direct correlation was shown with those isolated from local human cases of food poisoning. Evidence indicated that the most probable source of these pathogens was rubbish tips, which were feeding sites lying within the flight paths of the birds. A salmonella cycle involving both human and animal populations was discussed. Proposals were made for the control or possible eradication of this large, well entrenched, not easily accessible colony. (Humphreys-ISWS)
W79-04843

USE OF CHLORINE TO CONTROL OTEC BIOFOULING,
Ecological Analysts, Inc., Melville, NY.
J. A. Fava, and D. L. Thomas.
Ocean Engineering, Vol. 5, p 269-288, 1978. 7 tab, 63 ref.

Descriptors: *Chlorine, *Aquatic microorganisms, *Pest control, *Energy conversion, *Heat exchangers, *Power plants, Condensers, Reviews, Water quality, Feasibility studies, Corrosion, Chlorination, Slime, Pesticides, Antifouling materials, Invertebrates, Pesticide residues, *Ocean Thermal Energy Conversion(OTEC), *Biofouling.

The applicability of chlorine to control Ocean Thermal Energy Conversion (OTEC) biofouling was investigated. Onsite hypochlorite generation was found to be the preferred method of chlorination. The major fouling organisms of concern to OTEC are the microfouling organisms, that is, initial slime layers. However, macrofouling organisms may become a problem after several years of plant operation. Continuous low-level chlorination is more effective against hard-shelled macrofouling organisms and soft-shelled organisms, whereas intermittent chlorination will control slimes and soft-shelled organisms. Actual on-site experimentation is needed before effective doses and chlorination regimes can be recommended. The doses and regimes may vary depending upon whether the condenser and/or evaporator heat exchangers are chlorinated. (Katz-EIS)
W79-04847

AMBIENT CONCENTRATIONS OF PCBS IN THE SOUTHEAST FROM STORET DATA AND SELECTED EPA STUDIES,
Environmental Protection Agency, Athens, GA. Surveillance and Analysis Div.
For primary bibliographic entry see Field 5A.
W79-04848

TEMPERATURE INFLUENCES ON GROWTH OF AQUATIC ORGANISMS,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5C.
W79-04851

IMPINGEMENT AND ENTRAINMENT OF FISHES AT THE SAVANNAH RIVER PLANT AND NPDES 316B DEMONSTRATION,
DuPont de Nemours (E.I.) and Co., Aiken, SC. Savannah River Lab.
R. W. McFarlane, R. F. Frietsche, and R. D. Miracle.
Report Number DP-1494, 1978. 68 p. 35 fig, 19 tab, 17 ref.

Descriptors: *Entrainment, *Mortality, *Nuclear powerplants, Cooling waters, Intakes, Sunfishes, Channel catfish, Yellow perch, Fish eggs, Larval growth stage, Fish reproduction, Fish populations, Plankton.

Environmental impacts of the Savannah River Plant's withdrawal of Savannah River water include impingement of juvenile and adult fish on trash removal screens, and entrainment of planktonic fish eggs and larval fish into the pumping system. The fish impingement rate at the plant ranks very low in comparison with electric power plants on inland waters. Thirty-five species of fishes were impinged during 1977. The average impingement rate of 7.3 fish per day extrapolates to 2,680 fish per year. No single species comprised more than 10% of the sample. The most commonly impinged species were bluespotted sunfish, warmouth, channel catfish, and yellow perch. The relative abundance of those species impinged deviates from their relative abundance in the canal fish population. Assuming 'worst case conditions,' 6.8 million eggs (9.5%) and 19.6 million larvae (9.1%) were lost due to entrainment. In the absence of reliable fish data regarding the size of the spawning populations and recent population trends, the effect of a maximum 10% loss cannot be estimated. (Deal-EIS)
W79-04879

THE DISTRIBUTION AND ABUNDANCE OF SUBMERGED AQUATIC MACROPHYTES IN A REACTOR COOLING RESERVOIR,
Dupont de Nemours (E. I.) and Co., Aiken, SC. Savannah River Lab.
J. B. Grace.
MS Thesis, Clemson University, Clemson, South Carolina. Report Number DP-MS-77-99, 1977. 152 p, 32 fig, 19 tab, 3 append, 50 ref.

Descriptors: *Nuclear powerplants, *Thermal pollution, *Plant growth, Biomass, Growth rates, Spatial distribution, Heated water, Plant physiology, Plant populations, Chemical analysis, Water pollution effects, Aquatic plants, *Tissue analysis, *Macrophytes, *Myriophyllum, *Eleocharis, *Species diversity.

Measurements of ash-free dry weight were used to characterize the effects of heated effluents on submerged macrophytes in a reactor cooling reservoir. Myriophyllum spicatum comprised more than 50 percent of the total biomass in the areas sampled. The species occurred at depths less than 3m in unheated locations, but not at depths deeper than 3m in heated locations. At depths less than 3m, M. spicatum was most abundant in heated locations 600m-1600m from the point where the heated effluent enters the reservoir. However, the amount of biomass of M. spicatum was greatly reduced in locations less than 400m from the discharge. Examination of the vertical distribution of the shoot biomass of Myriophyllum revealed that plants in heated areas grew closer to the water surface than plants in unheated areas. The biomass of the second most abundant species, Eleocharis acicularis, was less at 0.5m depths in heated areas (more than 5C warmer than unheated areas) than at equal depths in unheated areas. Species diversity was greater at heated locations because of a greater equitability (i.e. evenness of distribution of biomass) among species. (Deal-EIS)
W79-04880

THE POTENTIAL IMPACTS ON AQUATIC ECOSYSTEMS FROM THE RELEASE OF TRACE ELEMENTS IN GEOTHERMAL FLUIDS,
Oak Ridge National Lab., TN.
R. M. Cushman, S. G. Hildebrand, and R. W. Brocksen.
Environmental Sciences Division Publication No. 1097, 1977. 28 p, 4 tab, 32 ref.

Descriptors: *Geothermal studies, *Toxicity, *Trace elements, *Thermal power, Hydrothermal studies, Path of pollutants, Industrial wastes, Chemical wastes, Public Health, Commercial fishing, Electric powerplants, Mortality, Water chemistry, Water quality, Chemical analysis, *Bioaccumulation.

Geothermal energy will likely constitute an increasing percentage of our nation's future energy 'mix', both for electrical and nonelectrical uses. Associated with the exploitation of geothermal resources is the handling and disposal of fluids which contain a wide variety of potentially toxic trace elements. Analyses are presented of 14 trace elements found in hydrothermal fluids from various geothermal reservoirs in the western United States. Potential impacts are conservatively assessed on the basis of (1) toxicity to freshwater biota, and (2) bioaccumulation in food fish to the point where consumption might be hazardous to human health. Trace element concentrations generally range from benign levels which might prove toxic to freshwater biota and contaminate food fisheries. We stress the need for site-specific analyses and careful handling of geothermal fluids in order to minimize potential impacts. (Deal-EIS)
W79-04881

GENERAL LAWS OF THE MIGRATION OF PESTICIDE RESIDUES IN THE DELTA LANDSCAPE UNDER IRRIGATION,
Akademiya Nauk SSSR, Pushchino. Inst. of Agrochemistry and Soil Sciences.
M. S. Sokolov.
In: Symposium on Environmental Transport and Transformation of Pesticides, October, 1976, Tbilis, USSR. EPA-600/9-78-003, p 38-46. February, 1978.

Descriptors: Pesticide residues, *Pesticides, Pollutants, Herbicides, Surface runoff, Subsurface runoff, Self-purification, Migration, Water pollution, Sorption, *Runoff.

The process of migration determines diverse aftereffects caused by biocides and other xenobiotics (landscape-regional, regional-basin and global ones) in the biosphere. Migration can be characterized as a complex of processes of redistribution of xenobiotics (and the products of their transformation) in space and in time. In the process of redistribution a pesticide can be transformed into various products. The leftovers of the parent compound together with the products of its transformation are defined as pesticide residues. Xenobiotics are mainly transported in aquatic medium, in atmosphere and through organism migration. In the aquatic medium xenobiotics are transported with the surface and subsurface runoff. In the first case, the compounds are transported in the form of

a liquid runoff (true solutions of electrolytes, compounds with neutral molecules, and colloidal solutions), and in the form of a solid runoff (suspensions, sorbed substances with precolloidal particles or organo-mineral colloids). The subsurface transport of xenobiotics is carried out principally in the form of a liquid runoff. This paper reviews and analyzes investigations conducted on the aspect of migration and transport of pesticide residues through surface and subsurface runoff. (Skogerboe-Colorado State)
W79-04919

PREDICTING AND SIMULATING PESTICIDE TRANSPORT FROM AGRICULTURAL LAND: MATHEMATICAL MODEL DEVELOPMENT AND TESTING,
Environmental Research Lab., Athens, GA.
G. W. Bailey, and H. P. Nicholson.
In: Symposium on Environmental Transport and Transformation of Pesticides, October, 1976, Tbilis, USSR. EPA-600/9-78-003, p 30-37, February 1978. 26 ref.

Descriptors: *Pesticide kinetics, Pesticide toxicity, Environmental effects, Computer models, *Mathematical models, Simulation analysis, Small watersheds, Basins.

The transport of pesticides from agricultural lands and other compartments of the environment has generated public apprehension concerning the fate and effects of these compounds. Legislative mandates require guidelines to be developed covering pesticide use in order to prevent or minimize water pollution resulting from pesticide transport from agricultural land. Computer simulation models of the dynamic multiple rainfall-event type are being developed and refined to describe and predict quantitatively transport of pesticides from soil as a function of agricultural management practices, watershed characteristics, climatic factors, and properties of soils and pesticides. This paper discusses the steps involved in development, testing and verification of such models. (Skogerboe-Colorado State)
W79-04920

CERTAIN LAWS OF ORGANOCHLORINE PESTICIDE REDISTRIBUTION IN THE SOIL-WATER, SOIL-PLANT SYSTEM,
Institute of Experimental Meteorology, Obninsk (USSR).
G. G. Zhdamirov, E. E. Popov, and N. F. Lapina.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 714, Price codes: A11 in paper copy, A01 in microfiche. In: Symposium on Environmental Transport and Transformation of Pesticides, October, 1976, Tbilis, USSR. EPA-600/9-78-003, p 47-60. February, 1978. 4 fig, 3 tab, 9 ref.

Descriptors: Pesticides, *Pesticide residues, Evaporation, Sorption, DDT, Environmental effects, Persistence, Barley, Clovers, *Organochlorine pesticides.

One objective was to find the simplest method of estimating organochlorine pesticide evaporation from soils, water, and surfaces. The other objective was to determine the quantitative characteristics of pesticide transport into various species of plants and their distribution in aerial and root parts of plants depending on their content in soil. (Skogerboe-Colorado State)
W79-04921

AQUATIC DISPOSAL FIELD INVESTIGATIONS, DUWAMISH WATERWAY DISPOSAL SITE, PUGET SOUND, WASHINGTON; APPENDIX D: CHEMICAL AND PHYSICAL ANALYSES OF WATER AND SEDIMENT IN RELATION TO DISPOSAL OF DREDGED MATERIAL IN ELLIOTT BAY; VOL. II: SEPT.-DEC. 1976,
Washington Univ., Seattle. Lab. of Radiation Ecology.
S. Sugai, W. R. Schell, A. Nevissi, S. Olsen, and D. Huntamer.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-77-24, June 1978 (in two volumes). 130 p, 19 tab, 1 fig, 1 append, 13 ref.

Descriptors: *Aquatic environment, *Bottom sediments, *Chemical analysis, *Water analysis, *Washington, On-site investigation, *Dredged material disposal, Dredged material, *Waste disposal sites, *Elliott Bay(WASH).

Extent and duration of changes in chemical characteristics of Elliott Bay, Washington, were evaluated six and nine months after disposal of dredged materials from the Duwamish River. The seawater, sediment, and interstitial water were analyzed for the following chemical parameters: Seawater (Suspended solids, arsenic, manganese, mercury, reactive silicate, inorganic phosphate, nitrate, and ammonia); Sediment (Free and total--acid soluble--sulfide, manganese, chromium, arsenic, mercury, and particle size); Interstitial water (Arsenic, manganese, reactive silicate, ammonia, and inorganic phosphate). Temporal, depth, and spatial changes in concentrations of chemical variables were evaluated at disposal and reference sites. Results showed only minimal changes in trace metal concentrations in the water column above the disposal site, but lower Eh and pH values in the sediments than at the reference site. The manganese, inorganic phosphate, and ammonia concentration values were greater in interstitial waters at the disposal site than at the reference site. (See also W79-04928) (WES)
W79-04929

TRACE ELEMENTS IN THE SEDIMENTS OF THE BUFFALO RIVER, ARKANSAS,
Arkansas Univ., Fayetteville.
For primary bibliographic entry see Field 5A.
W79-04956

THE EFFECT OF RECREATION ON WATER QUALITY,
California State Coll., Stanislaus, Turlock. Dept. of Chemistry.
J. E. Byrd, and M. J. Perona.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 012, Price codes: A03 in paper copy, A01 in microfiche. California Water Resources Center, University of California, Davis. Technical Completion Report, January 1979. 26 p, 13 fig. (California Water Resources Center Project UCAL-WRC-W-531). OWRT A-064-CAL(1).

Descriptors: *Recreation, *Multiple-Purpose reservoirs, *Lead, *Heavy metals, *Pollutant identification, *Chemical analysis, Boating, Water sports, Boat launching ramps.

The purpose was to assess the effect of motorboat usage on the long-term lead concentration of a multipurpose reservoir, Turlock Lake in Stanislaus County, California. As the study was made during two drought years, it was possible to examine the effects of large volume changes in lake. Samples were taken at weekly intervals at the inlet canal where water enters the lake, at the outlet and at the boat dock. An apparent correlation was found between the lead level at the boat dock and the boats per-unit-volume. Also, at the boat dock, the largest lead concentration correlated with the highest boat concentration. The inlet and outlet lead data obtained were treated in terms of a simple plug-flow model. The increase in the lead level of the water as it passes through the lake is greater, by at least a factor of 15, than would be expected on the basis of the number of boats on the lake. The lead concentration was found to correlate with lake volume. Experiments were done to find if an alternate source of lead in the lake is the sediment. The mechanism linking lake volume and lead concentration is unclear but is likely to involve migration of lead from the sediment, which was found to contain exchangeable lead, and/or biotic processes. (Snyder-Calif-Davis)
W79-04963

OCCURRENCE OF A NEW TYPE OF SHELLFISH POISONING IN THE TOHOKU DISTRICT,
Tohoku Univ., Sendai (Japan). Lab. of Food Hygiene.
For primary bibliographic entry see Field 5A.
W79-04970

AMMONIA PRODUCTION RATES OF ARTEMIA SALINA UNDER VARIOUS CULTURE CONDITIONS,
California Univ., Bodega Bay. Bodega Marine Lab.
W. L. Moffett, and W. S. Fisher.
Journal of the Fisheries Research Board of Canada, Vol. 35, p 1643-1648, 1978. 1 fig, 2 tab, 24 ref.

Descriptors: *Brine shrimp, *Ammonia, *Animal wastes(Wildlife), Animal metabolism, Waste identification, Toxicity, Aquiculture, Salinity, Hydrogen ion concentration, Lobsters, Crustaceans, Growth stages, Water chemistry, Water analysis, Enzymes, Digestion, *Platymonas, *Nauplii, *Metabolites.

Artemia salina are used as a live food in the cultivation of several Crustacea and their metabolites add to the metabolites of the cultured species. Because it is toxic, ammonia was monitored over 7-d periods while A. salina nauplii and adults were held in a variety of culture conditions. Ammonia production increased with increasing temperature between 15-25C. Production of ammonia by nauplii was density dependent. No change in ammonia production was shown by adults with alteration of density (200-2000 A. salina/L), salinity (10-50%) or pH (7.0-9.0), or when fed twice daily with 50,000-100,000 cells Platymonas sp./mL. Artemia salina fed ad lib. to cultured experimental lobsters would contribute about 46% of the total ammonia in the culture system. (Deal-EIS)
W79-04971

CADMIUM TURNOVER IN THE SHORE CRAB CARCINUS MAENAS,
Newcastle-upon-Tyne Univ. (England). Dept. of Zoology.
D. A. Wright, and C. C. Brewer.
Marine Biology, Vol. 50, p 151-156, 1979. 5 fig, 1 tab, 8 ref.

Descriptors: *Cadmium, *Crabs, *Absorption, Heavy metals, Path of pollutants, Animal physiology, Animal metabolism, Chemical reactions, Chemical analysis, Biochemistry, Proteins, Radioactivity techniques, Tracers, Salinity, *Tissue analysis.

During cadmium uptake by the shore crab cadmium appears in both haemolymph and urine within 1 h, and comes into equilibrium with the haemolymph after some 60 h. The equilibrium concentration for haemolymph cadmium is always considerably less than that of the external medium, whether the latter is close to background level or at the artificially high concentration of 2.2 mg 1-1. Despite earlier evidence that cadmium entering the haemolymph is mainly bound to protein, current results show most of this to be freely labile and quickly displaced by cadmium taken up subsequently. There is some evidence to suggest that cadmium is passed on from the haemolymph to the hepatopancreas. A large proportion of whole-body cadmium is adsorbed onto the exoskeleton and gills. The comparatively rapid efflux of 109Cd from loaded crabs over a period of 1 week is mainly due to desorption of this cadmium from the outer body surface. (Deal-EIS)
W79-04973

AN EROSION MODEL FOR ARID WILDLAND WATERSHEDS,
Utah State Univ., Logan. Dept. of Soil Science.
For primary bibliographic entry see Field 2J.
W79-04994

CLOSED FORM SOLUTION FOR PESTICIDE LOSS IN RUNOFF WATER,

Cornell Univ., Ithaca, NY. Dept. of Agricultural Engineering.
T. S. Steenhuis, and M. F. Walter.
Paper No. 78-2031, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah. 27 p, 4 fig, 5 tab, 17 ref, append. ASAE, St. Joseph, Michigan.

Descriptors: Pesticide removal, *Pesticide residues, Runoff, Erosion, Overland flow, Adsorption, Regression analysis.

A closed form solution for pesticide loss in overland flow is presented. All input variables are easily measurable except the depth of the mixing zone. A depth of 0.9 cm for this zone was found by regression analysis using pesticide runoff data reported in literature. For verification, pesticide runoff data from Southern Georgia was used and a reasonable agreement existed between observed and predicted values. (Skogerboe-Colorado State)
W79-05000

5C. Effects Of Pollution

FACTORS AFFECTING ACCURACY OF ICHTHYOPLANKTON SAMPLES USED IN POWER PLANT ENTRAINMENT STUDIES,
Virginia Inst. of Marine Science, Gloucester Point.
R. R. Bowles, J. V. Merriner, and J. Boreman.
Available from Supt. of Documents, GPO, Washington, DC 20402. Report No. FWS/OBS-76/20.7, June 1978. 14 p, 3 fig, 2 tab, 24 ref.

Descriptors: *Sampling, *Ichthyoplankton, *Equipment, *Plankton nets, Pumps, Environmental effect, Powerplants, Entrainment, Investigations, Biology, Aquatic habitats.

Ichthyoplankton sampling gear currently in use, abiotic and biotic factors which may affect attainment of 'representative' samples, and items to be considered in the design and or evaluation of an ichthyoplankton sampling program are reported. In evaluating and comparing the types of sampling gear presently used, it was found that circular meter nets were superior to 0.5 m nets, and that brideless nets were more efficient than 0.5m or 1m nets. Net and pump comparison results were variable. Abiotic factors affecting samples used to assess powerplant impacts include characteristics of the gear, sampling environment, and the powerplant; biotic factors include characteristics of the target organism. A gear selection check list is provided. (Davison-IPA)
W79-04504

LIMNOLOGICAL ASPECTS OF LAKE MEAD, NEVADA-ARIZONA,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 2H.
W79-04506

EFFECTS OF GEOTHERMAL ENERGY DEVELOPMENT OF FISH AND WILDLIFE,
Oak Ridge National Lab., TN. Environmental Sciences Div.
G. W. Suter, II.
Report No. FWS/OBS-76/20.6, October 1978. 22 p, 2 fig, 2 tab, 31 ref. W-7405-eng-26.

Descriptors: *Geothermal studies, *Fish, *Wildlife, *Environmental effects, Habitat improvement, Air pollution, Water pollution, Water pollution effects, Air pollution effects, Accidents, Hazards, Technology, Research and development.

The nature and technologies for exploration, extraction and use of geothermal resources are reported. The three types now being used, or of potential use are: hydrothermal, geopressured, and hot dry rock. The environmental impacts of the gaseous emissions, particulate emissions, and liquid emissions on fish and wildlife are examined. Potential accidents associated with geothermal development include well blowouts, pipeline ruptures, sump pump failure, holding pond overflow, subsidence, induced seismicity, and loss of thermal springs are discussed. The possibilities of habitat enhancement are explored. (Davison-IPA)
W79-04508

A BIOLOGIST'S MANUAL FOR THE EVALUATION OF IMPACTS OF COAL-FIRED POWER PLANTS ON FISH, WILDLIFE, AND THEIR HABITATS,
Argonne National Lab., IL.
B. G. Lewis, P. C. Chee, R. M. Goldstein, F. C. Kornegay, and D. L. Mabes.
Report No. FWS/OBS-78/75, August 1978. 225 p, 22 fig, 36 tab, 14 ref, 8 append.

Descriptors: *Powerplants, *Environmental effects, *Habitats, *Fish, *Wildlife, *Coal-fired powerplants, Effluents, Solid wastes, Balance of nature, Ecology, Biology.

Information to aid biologists in the review of environmental impact statements and environmental reports is presented. Although many approaches to the assessment of impacts to biota from the operation of a coal-fired powerplant are discussed, the major approach taken here is a 'best judgement' evaluation, made by a biologist familiar with the locality and region. A description of coal-fired powerplants emphasizing components unique to these installations is followed by topical sections corresponding to powerplant features with the potential for adverse effects on fish, wildlife, and their habitats. These sections are: coal slurry pipelines, coal cleaning, coal storage, limestone preparation and storage, air emissions, liquid effluents, solid wastes, and conversion to coal. Each section contains a description of the feature involved, standards and criteria, quantification, information requirements and sources, impact analysis, mitigative measures, additional data sources, and references. (Davison-IPA)
W79-04509

MUNICIPAL WASTEWATER AQUACULTURE,
Robert S. Kerr Environmental Research Lab., Ada, OK. Wastewater Management Branch.
For primary bibliographic entry see Field 5D.
W79-04528

SOURCE ASSESSMENT: RAIL TANK CAR, TANK TRUCK, AND DRUM CLEANING, STATE OF THE ART,
Monsanto Research Corp., Dayton, OH.
For primary bibliographic entry see Field 5D.
W79-04529

POLLUTION CONTROL GUIDANCE FOR GEOTHERMAL ENERGY DEVELOPMENT,
Industrial Environmental Research Lab., Cincinnati, OH.
R. P. Hartley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-282 546, Price codes: A07 in paper copy, A01 in microfiche. Report No. EPA-600/7-78-101, June 1978. 134 p, 46 fig, 19 tab, 77 ref, 1 append. INE610.

Descriptors: *Pollution abatement, *Geothermal studies, *Environmental effects, *Energy, *Air pollution, *Water pollution control, *Regulation, *Electric powerplants, Solid wastes, Noise, Pollutants, Radionuclides, Radioactive wastes, California, Water pollution sources, Environmental Protection Agency, Water quality standards, Groundwater.

EPA regulations for geothermal energy development are summarized, and geothermal effluents and emissions are categorized: air and water pollutants, solid wastes, radiation, and noise. Discharges from geothermal activities are not viewed as threats to national health and welfare, but may well be locally significant. EPA goals include: (1) use of permits to control discharges prior to establishment of formal regulations, (2) effluent guidelines and revision of water quality standards, (3) regulations for subsurface disposal of spent geothermal fluid, (4) New Sources Performance Standards for gaseous emissions, (5) noise regulation under the Noise Control Act of 1972 or by state and local agencies, and (6) regulation of radioactivity under the water pollution, air pollution, and drinking water regulations. Very few pollution control technologies have been demonstrated for geothermal energy conversion systems. Current development is directed more toward electric power generation from high-temperature, liquid-dominated geothermal systems, and less toward direct heating uses, though the latter are more energy-efficient. The pollution potential of most exploitable geothermal resource probably lies between the extremes of the station at The Geysers, California which produces hydrogen sulfide, and the geothermal resources in California's Imperial Valley characterized by high salinity liquids. (Lynch-Wisconsin)
W79-04530

ENVIRONMENTAL ASSESSMENT OF COAL TRANSPORTATION,
PEDCo Environmental, Inc., Cincinnati, OH.
M. F. Szabo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-285 936, Price codes: A08 in paper copy, A01 in microfiche. Report No. EPA-600/7-78-081, May 1978. 142 p, 35 fig, 31 tab, 52 ref, 2 append. EHE 623. 68-02-1321.

Descriptors: *Water pollution sources, *Coals, *Transportation, *Environmental effects, *Pollution abatement, *Mining, *Pipelines, Water pollution control, Air pollution, Energy, Railroads, Slurries, Barges, Trucks, Conveyance structures, Coal mines, Technology, Effluents, Runoff, Storage, Mine wastes, Research and development, Research priorities, Public health, Toxicity.

Coal mining and preparation methods are discussed, environmental effects of coal transportation by slurry pipeline, railroad, barge, truck, and conveyer are identified, and recommendations are given for control technology research and development. Highest priority research needs: (1) toxic properties of effluents from coal cleaning and storage runoff; (2) pipeline breakage, water availability, reslurrying methods, slurry dewatering, fines treatment, and slurry water and corrosion inhibitor toxic properties; and (3) truck road damage. Transportation of coal in the U.S. is expected to reach 1.32 billion metric tons by 1985. Most effects of coal transportation are not critical in terms of health and welfare and could be reduced by control technology improvements, but coal preparation plant effluents, storage piles, and slurry lines represent toxic hazards, and the toxicity of storage pile runoff and coal slurries is still undefined. Emergency procedures for slurry line breakage must be better defined. Railroads carry most of the coal transported more than 160 km; barges are also used for long-distance transport. Although coal slurry pipelines are capable of long-distance transport, only one is in operation at present. Trucks, conveyer belts, and pneumatic pipelines are functional only over relatively short distances. Energy consumption must be taken into account in planning coal transportation systems. (Lynch-Wisconsin)
W79-04531

INFLUENCE OF TURBIDITY ON FISH ABUNDANCE IN WESTERN LAKE SUPERIOR,
Wisconsin Univ.-Superior. Dept. of Biology.
W. A. Swenson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 502, Price codes: A05 in paper copy, A01 in microfiche. EPA-600/3-78-067, July 1978. 83 p, 16 fig, 21 tab, 40 ref, 1 append. R802455.

Descriptors: *Lake Superior, *Turbidity, *Fish, *Red clay, *Predation, *Water pollution effects, *Soil erosion, *Fish management, *Commercial fishing, Great Lakes, Lakes, Smelts, Herrings, Lake trout, Walleye, Coregonus artedii, Osmerus mordax, Stizostedion vitreum vitreum, Salvelinus namaycush, Zooplankton, Food habits, Light pen-

etration, Animal behavior, Clays, Suspended solids.

One result of turbidity in western Lake Superior caused by erosion of red clay from the shore is that rainbow smelt (Osmerus mordax) respond by moving into the upper 12 m of water where their predation on larval lake herring (Coregonus artedii) increases. Predation by the smelt (introduced artifically into the lake) has contributed to the decline of the formerly abundant western Lake Superior herring population and its commercial fishery. Prior to introduction of the smelt, which became abundant in the 1940s, the turbidity promoted herring production by stimulating high zooplankton densities in near-surface waters where larval herring concentrate. Walleye (Stizostedion vitreum vitreum) tend to concentrate in turbid water where reduced light intensity enhances their feeding success and where presence of smelt increases their food availability. Lake trout (Salvelinus namaycush) showed partial avoidance of turbidity in lake and laboratory tests. Red clay turbidity does not directly influence fish survival, but behavioral changes of fish result in major indirect turbidity effects. High plankton densities and increasing herring growth rates suggest that the herring decline is not a result of food competition with smelt. Rather than attempting to control turbidity, direct fish management is recommended including hatchery rearing of herring to larger size, selective stocking of smelt, and use of walleye predation to control smelt populations. (Lynch-Wisconsin)
W79-04532

BROWNS FERRY BIOTHERMAL RESEARCH SERIES. I. COLONIZATION BY PERIPHYTON, ZOOPLANKTON, AND MACROINVERTEBRATES,
Tennessee Valley Authority, Decatur, AL. Div. of Forestry, Fisheries and Wildlife Development.
B. J. Armitage, T. D. Forsythe, E. B. Rodgers, and W. B. Wrenn.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 675, Price codes: A04 in paper copy, A01 in microfiche. EPA-600/3-78-020, February 1978. 9 fig, 9 tab, 13 ref. TV-35013A.

Descriptors: *Invertebrates, *Zooplankton, *Periphyton, *Wheeler Reservoir(AL), *On-site laboratories, *Colonization, *Reservoirs, *Heated water, Algae, Tennessee Valley Authority, Browns Ferry Biothermal Research Station(AL), Fish food organisms, Ecology, Food chains, Tennessee River, Species composition, Species diversity, Habitats, Dominant organisms, Seasonal, Water temperature, Biological communities, Substrates, Research equipment, Mollusks, Insects, Faunal lists, Floral lists.

To study effects of increased water temperature on aquatic organisms at the Browns Ferry Biothermal Research Station on Wheeler Reservoir (Tennessee River), near Athens, Alabama, experimental channels were successfully colonized by Tennessee River organisms over a three-year period (1974-76) under ambient temperature conditions. This report documents colonization by primary and intermediate trophic levels during the first 24 months. Periphyton assemblages were highly productive and diverse, and colonization of bare surfaces was extremely rapid during summer. Abundant zooplankton was composed primarily of shallow-water forms. Macroinvertebrates quickly colonized the channels via inflowing water and air, were as diverse or more diverse than in the reservoir, and were composed of littoral and open-water taxa. Based on species composition, and algal and invertebrate densities, the channels accurately simulated reservoir ecosystems for these trophic levels. Channels drawn down for two months in late fall were successfully recolonized, with increased invertebrate densities. The 12 concrete channels, 114 m long, 4.3 m wide, and two m deep, have substrates of natural reservoir sediments and limestone rock arranged to provide six alternating pools and six rock areas per channel. Water is pumped from the reservoir at 0.66 cu m/min, and channel retention time is about 14 hrs. Dominant invertebrates (numerically) were Oligochaeta, Bivalvia, Amphipoda, Gastropoda, and Chironomidae. (Lynch-Wisconsin).
W79-04533

THE IMPACT OF TURPENTINE RECOVERY ON THE TOXICITY AND BOD OF KRAFT MILL EFFLUENTS,
Pulp and Paper Research Inst. of Canada, Pointe Claire, (Quebec).
A. Wong.
In: Canadian Pulp and Paper Association Technical Section, Spring Conference, May 17-21, 1978, Jasper, Alberta, Preprinted Proceedings, p 88-91. 5 fig, 5 ref, 5 tab.

Descriptors: *Pulp wastes, *Toxicity, *Biochemical oxygen demand, *Turpentine, Wastes, Industrial wastes, Water pollution sources, Pulp and paper industry, Effluents, Chemical oxygen demand, Water pollution, Foreign countries, Canada, Water pollution control, Waste treatment, Waste water treatment, Kraft mills, Ethanol, Methanol, Acetone.

Studies carried out at the Pulp and Paper Research Institute of Canada suggested that turpentine recovery under normal operating conditions at a kraft mill has little or no detectable effect on the tocicity of the combined mill effluent (CME). On the basis of the mill effluents tested, the concentration of turpentine was 6-100 ml/cu m CME if there was no recovery after condensation of digester relief or blow gases. Turpentine concentrations in excess of the above levels increased the toxicity in several samples of CME. Toxicities calculated from toxicity data of individual component streams of CME generally greater than those measured. For one Canadian kraft mill, BOD and COD increased by 29 and 12%, respectively, at 1.32% turpentine decanter effluent in CME. Without any separation of turpentine in the decanter, the corresponding conentration of pure turpentine in CME was estimated to be about 4.5 ml/cu m CME. However, the increases in BOD and COD are probably not due to turpentine. Water-soluble components such as methanol, ethanol, and acetone, which are normally present in digester blow gases are subsequently in the decanter effluent, should have large effects on the increases in BOD and COD. Thus, improvements in turpentine separation in the decanter, without further treatment of the decanter underflow, might not result in proportional decrease of BOD and COD in CME. (Swichtenberg-ICP).
W79-04534

NITRATE AND PHOSPHORUS RUNOFF LOSSES FROM SMALL WATERSHEDS IN GREAT LAKES BASIN,
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
B. G. Ellis, A. E. Erickson, and A. R. Wolcott.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 574, Price codes: A13 in paper copy, A01 in microfiche. EPA-600/3-78-0128, March 1978. 83 p, 12 fig, 27 tab, 1 ref, 2 append. R-802974-01-0.

Descriptors: *Small watersheds, *Nitrates, *Phosphorus, *Agricultural runoff, *Nutrients, *Crop production, Watersheds(Basins), Great Lakes, Michigan, Fertilizers, Fertilization, Nitrogen, Ammonium, Orthophosphate, Sediments, Storm runoff, Snowmelt, Storms.

Two small watersheds (0.80 and 0.55 ha) on the campus of Michigan State University, East Lansing, were planted in row crops and studied 1974-76 for nitrogen and phosphorus runoff losses. Relatively heavy January-March runoff was due mostly to snowmelt but also to rainfall, with loss of more water than sediment. A single heavy rain 18 April 1975 accounted for most water and sediment losses during the study. Corn cultivation on one watershed and soybeans on the other had no apparent differential effect on runoff. Most nitrogen lost during winter runoff was in the soluble nitrate/ammonium form and could be accounted for by snow nitrogen content. Total nitrogen content of runoff water was 5 ppm N. During summer 82-94% of total nitrogen in runoff was in sediment. Loss of soluble nitrogen during the growing season was only 1-3 kg/ha/yr, less than 1% of applied nitrogen in fertilizers, but excessive organic nitrogen was lost during a major storm (31 and 46 kg N/ha). While ammonium fertilizer applied did not move, it converted quickly to nitrate and nitrate nitrogen moved down into the soil profile. The watersheds were previously heavily fertilized, and absorption sites were saturated with phosphorus. About one-third of total phosphorus lost in water occurred in snowmelt runoff, again mostly accounted for by snow content. During the heavy storm 90% of phosphorus lost was in sediment. Fall nitrogen application is not recommended, and phosphorus should not be added if already high in the soil. (Lynch-Wisconsin)
W79-04535

EFFECTS OF DIVERSION AND ALUM APPLICATION ON TWO EUTROPHIC LAKES,
Kent State Univ., OH. Dept. of Geology.
D. G. Cooke, R. T. Heath, R. H. Kennedy, and M. R. McComas.
EPA-600/3-78-033, March 1978. 101 p, 25 fig, 24 tab, 66 ref, 1 append. EPA-R801936.

Descriptors: *Twin lakes(OH), *Aluminum sulfate, *Eutrophication, *Nutrient removal, *Diversion, *Lake restoration, *Water quality control, *Alum, Lakes, Ohio, Alkalinity, Sediments, Algae, Fish, Phytoplankton, Macrophytes, Aquatic weed control, Water pollution control, Nutrient loading, Nutrients, Coliforms, Sewage disposal, Phosphorus, Hypolimnion, Trophic level, Septic tanks, Nonpoint pollution, Point pollution.

Diversion in 1972 of septic tank drainage away from East and West Twin Lakes, two shallow, eutrophic, dimictic lakes in northeastern Ohio, resulted in prompt return to near-zero fecal coliform levels in groundwater, streams, and lakes. However, phosphorus income failed to decrease to an acceptable level by 1976 due to continued inputs of untreated storm flow and nonpoint urban runoff. Lake phosphorus concentrations remained at typically eutrophic levels. Following an initial reduction in algal standing crop in 1973 there was little subsequent change. In July 1975 addition of a maximum hypolimnetic dose of alum (aluminum sulfate) to West Twin Lake effectively retarded phosphorus release from lake sediments for at least one year, with no adverse side effects observed. East Twin Lake served as a control. The maximum aluminum dose, defined as that above which residual dissolved aluminum concentration exceeds the trout-toleration limit of 0.05 mg Al/1, was linearly related to alkalinity and could be determined by simple jar tests. Net internal phosphorus loading was only partially reduced by the alum treatment; the untreated upper zone of the lake (specifically the littoral) was apparently a significant internal source of phosphorus. Alum reduced epilimnetic phosphorus concentration and algal standing crop, but both remained at eutrophic levels; cyanophyte dominance was altered to co-dominance of cyanophytes with dinoflagellates and diatoms. (Lynch-Wisconsin)
W79-04536

FIRST AMERICAN-SOVIET SYMPOSIUM ON THE BIOLOGICAL EFFECTS OF POLLUTION ON MARINE ORGANISMS.
Held 20-24 September 1976, Gulf Breeze, Florida. Environmental Protection Agency Publication No. EPA-600/9-78-007, May 1978. 166 p.

Descriptors: *International cooperation, *Soviet Union, *United States, *Methodology, *Pollutants, *Oceans, *Primary productivity, *Water pollution effects, Phytoplankton, Bacterioplankton, Algae, Heavy metals, Pesticides, Radioactivity, Oil pollution, Testing procedures, Analytical techniques, Model studies, Simulation analysis, Mathematical models, Ecosystems, Bioindicators, Marine biology, Microorganisms, Measurement, Toxicity, Poisons, Bioassay, Aquatic animals.

The first Soviet-American symposium on hydrobiological methods for analyzing marine pollution, held 20-24 September 1976 at Gulf Breeze, Florida, followed a series of joint Soviet-American studies of the project 'Influence of Pollutants on Marine Organisms' provided for in the 1972 US-USSR Agreement on Cooperation in the Field of Environmental Protection. The 15 papers deal with modelling of the impact of marine pollution; methods of measuring phytoplankton production in the open sea; abundance of sympatric species and the exponentially broken rod model; effects of radioactivity, pesticides, and heavy metals; estimation of bacterioplankton biomass and growth; standardization of methods for measuring microbiological production and ecosystem research; bioindicators of pollution; persistence limits of ecosystems; and a proposed program for monitoring petroleum-oxidizing microorganisms as oil pollution indicators. Appendices include an abstract of a paper on microcosms as pollution indicators, a report on a Soviet-American research voyage to compare methods of measuring phytoplankton productivity, and a synopsis of several symposium discussions. Future joint projects proposed were: (1) model development and validation, (2) development of a new method for determining primary productivity and influences on it by pollutants, (3) microbiology, and (4) effects of transuranic radionuclides. (See W79-04538 thru W79-04553). (Lynch-Wisconsin)
W79-04537

DESIGN OF SIMULATION MODELS TO DETERMINE BIOLOGICAL IMPACT OF POLLUTANTS ON THE MARINE ENVIRONMENT,
Rosenstiel School of Marine and Atmospheric Science, Miami, FL.
S. C. Snedaker.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978, p 1-9. 5 fig, 5 ref.

Descriptors: *Pollutants, *Water pollution effects, *Simulation analysis, *Mathematical models, *Marine biology, *Ecosystems, Model studies, Environmental effects, Energy budget, Energy, Biological communities, Biodemographic models, Bioenergetic models, Biogeochemical models, Forecasting, Oceans, Analytical techniques, Methodology.

Simulation models for determining pollutant impacts on marine biota, if they are conservative and reflect real-world, case/effect processes, fall into one of three categories posited by Quinlan: (1) biodemographic, (2) bioenergetic, or (3) biogeochemical. Pollution, though often difficult to define precisely, can be modelled relatively easily if a pollutant is regarded as inducing a stress which alters the potential energy-allocation process of a system--more energy goes into stress-compensating processes and less into competition. The affected system may exhibit many different types of compensatory responses depending on pollutant type and quantity. As pollution may significantly alter the system's basic network pattern, highly aggregated models insensitive to internal network changes may be most appropriate. A common inadequacy of biological models is to focus on component species and population assemblages rather than on the larger system. Odum's modelling methodology (1971) is particularly useful for simulating biological pollution impact because it permits rigorous models to be constructed easily, which include any observable or measureable process. Simulation exercises are viewed as a tool for understanding system processes rather than as the end result of research. (See also W79-04537) (Lynch-Wisconsin)
W79-04538

PROBLEMS OF MODELING THE EFFECT OF POLLUTION ON BIOLOGICAL SYSTEMS OF THE OCEAN,
Akademiya Nauk SSSR, Moscow. Inst. Okeanologii.
M. Y. Vinogradov.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978. p 10-21. 5 fig, 9 ref.

Descriptors: *Oceans, *Mathematical models, *Deterministic models, *Stochastic processes, *Ecosystems, *Marine biology, Model studies, Pelagic zone, Phytoplankton, Zooplankton, Fish, Cephalopods, Sea of Japan, Japan, Pollutants, Water pollution control, Methodology, Analytical techniques, Forecasting, Soviet Union, Algae.

Soviet modelling of effects of pollution on marine ecosystems has concentrated on two approaches: (1) deterministic models of pelagic ecosystems, and (2) special models in which pollution is considered a stochastic process. The homogeneity of pelagic ecosystems facilitates quantitative evaluation of pollution effects. Model structure must dynamically represent both temporal succession of pelagic associations, which affects response to contaminants, and the spatial movement of the water including its ascent into the euphotic layer to its subsequent descent. Pollution is most harmful in the zones of system formation: upwellings and divergences of flow in the tropics, and spring plankton development in temperature zones. The ecosystem can be represented as a set of near-autonomous elements connected by communication channels; signals comprise portions of matter (energy) or information. Two transmittal methods can be distinguished (illustrated by the Sea of Japan): (1) flow, related to a transformation of matter or energy, and (2) transfer, related only to active or passive displacements of water components. The entire system can be divided into cells such that within each cell elements communicate only by flow, while between cells transmission of matter and energy is accompanied by transfer. The basis of stochastic models is that incidence of a pollutant into the ecosystem occurs randomly in time and quantity. (See also W79-04537). (Lynch-Wisconsin)
W79-04539

AMERICAN METHODS FOR MEASURING PHYTOPLANKTON PRODUCTION IN THE OPEN OCEAN,
State Univ. of New York, Stony Brook. Marine Sciences Research Center.
E. J. Carpenter, and W. E. Esaias.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978. p 22-36. 4 fig, 33 ref. NSF DES76-01405.

Descriptors: *Oceans, *Pelagic, *Methodology, *Measurement, *Phytoplankton, *Primary productivity, Testing procedures, Particulates, Analytical techniques, Absorption, Carbon radioisotopes, Scintillation fluors, Darkness, Filtration, Chlorophyll, Light intensity, Light penetration, Salinity, Silica, Incubation, Algae.

Biases in the carbon-14 light-dark bottle method for measuring open ocean phytoplankton productivity may cause two- or three-fold underestimates. Problems include poor carbon-14 isotope quality, high dark-bottle counts, scintillation fluors, and loss of carbon-14 when drying filters. Methods to compensate are designed for pelagic water with low concentration of particulate matter, high light penetration, and relatively constant concentration of dissolved inorganic carbon; with modifications, they can be adapted to low-salinity water of high detrital content. General recommendations: (1) samples should be collected from at least five depths approximating 100% (surface), 50%, 25%, 10%, and 1-3% irradiance, and strong chlorophyll maxima should be sampled; (2) a nontoxic, nonmetal, preferably opaque sampler must be used; (3) artifically illuminated incubation boxes with daylight fluorescent bulbs expose samples to constant, saturating irradiance, and compensate for overcast days; (4) exposures in either ambient or artificial light incubators must not exceed three hours; (5) carbon-14 bicarbonate stocks should be purchased as a crystalline solid and ampulated by the investigator, because commercial ampulated stocks often contain toxic material and high silica concentrations; and (6) the scintillation counter method allows relatively easy standardization of stocks and efficient counting of samples, while use of the thin-window gas-flow beta results in many difficulties. Other aspects are discussed. (See also W79-04537). (Lynch-Wisconsin)
W79-04540

RELATIVE ABUNDANCE OF SYMPATRIC SPECIES AND MODEL OF EXPONENTIALLY BROKEN ROD (EBR),
Moscow State Univ. (USSR). Dept. of Hydrobiology.
V. D. Fedorov.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978. p 37-42. 1 fig, 4 tab, 24 ref.

Descriptors: *Exponentially broken rod model, *Broken rod model, *Abundance, *Phytoplankton, *Biological communities, *Ecology, *Mathematical models, Model studies, Sympatric species, Plant populations, Forecasting, Algae, Distribution, Niches, Biotopes, Species composition, Equations, Competition, Ranking.

The 'Broken Rod' model proposed by McArthur in 1957 for the possible distribution of N individuals among w species (applied to tropical birds) is modified here as the 'exponentially broken rod model' (EBR) to improve predictive capabilities. McArthur's model suffered from restrictive assumptions (that sympatric equilibrium species of approximately the same size and with constant total density are confined to a relatively homogenous biotope), which often results in poor agreement between predictions and observed ecological data. ERB model predictions correlate better with observed data, at least for phytoplankton. McArthur's model assumes that in a homogeneous biotope groups of closely related species retain a stable population ratio, and since relative abundance is constant, it can be predicted by a model. The assumption that in a system in equilibrium niches of sympatric species are contiguous without much overlap presupposes the absence of interspecific competition. Formally, the case is analogous to a segment of a rod of unit length (the biotope) partitioned into w parts by w-1 points falling on it; length of parts is proportional to population sizes of individual species. The EBR model assumes a rod of unit length broken into w parts, and that the w-1 breaking points are independent random variables identically distributed on the interval 0, 1, with density expressed by an equation. A ranking is obtained by ordering the parts after the rod is broken in a decreasing (random) sequence. (See also W79-04537). (Lynch-Wisconsin)
W79-04541

IMPACT OF RADIOACTIVITY ON THE MARINE ENVIRONMENT,
National Marine Fisheries Service, Beaufort, NC.
F. A. Cross.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978. p 63-72. 2 fig, 1 tab, 27 ref.

Descriptors: *Oceans, *Radioactive wastes, *Water pollution effects, *Radioisotopes, *Nuclear wastes, *Radioactivity effects, *Radioecology, Radioactivity, Population dynamics, Phytoplankton, Algae, Marine algae, Fallout, Air pollution effects, Ecology, Ecosystems, Laboratory tests, Water pollution sources, Plutonium, Nuclear powerplants, Poisons, Toxicity, Background radiation.

Introduction of radionuclides into oceans by man has not caused significant adverse effects on marine populations or ecosystems, as assessed by three evaluation methods using published data. Methods: (1) comparison of natural background dose rates to aquatic organisms with dose rates received from artificial radionuclides; (2) compari-

son of artificial radionuclide dose rates with results of laboratory irradiation experiments on marine species; and (3) field studies. Measurable changes in marine populations or ecosystems have not been observed in regions receiving artificial radionuclies; moreover, most estimates of dose rates from such inputs are comparable to natural background dose rates, and are significantly below dose rates generally shown to cause measureable damage to organisms in the laboratory. Though discussions in the literature have focused on somatic effects, no evidence of adverse genetic effects has surfaced. If atmospheric nuclear weapons testing is not resumed on a large scale, the last major ocean contamination will have occurred in the early 1960s, and fallout radioactivity levels have decreased since that time. No widespread contamination has been caused by nuclear power plants or nuclear-powered ships. Major future hazards are catastrophic accidents and plutonium, the most toxic radionculide known. (See also W79-04537). (Lynch-Wisconsin)
W79-04542

THE EFFECT OF RADIOACTIVE POLLUTION OF RESERVOIRS ON FISH,
All-Union Research Inst. of Marine Fisheries and Oceanography, Moscow (USSR).
I. A. Shekhanova.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978. p 73-76.

Descriptors: *Fish, *Reservoirs, *Water pollution effects, *Radioactivity effects, *Bioaccumulation, *Reproduction, *Fertility, Radioactive wastes, Coasts, Oceans, Ocean dumping, Water pollution sources, Radioactive waste disposal, Chronicity effects, Cesium, Strontium, Rivers, Lakes, Bottom fish, Sediments.

Due to open dumping of low-activity radioactive wastes in coastal regions of seas, bays and inland reservoirs, contamination artificial radionuclides is increasing. Strontium-90 concentration is 0.1-0.2 pCe/1 in oceans, 0.5-1.5 pCe/1 in inland and marginal seas, 1.5-5.0 pCe/1 in rivers, 3.5-12.0 pCe/1 in lakes, and in a number of reservoirs cumulative beta-activity fluctuates 25-2000 pCe/1. Long term biological effects on fish in such waters depends on the absorbed dose and on the cumulative radioactive dose. Internal radiation sources are radionuclides in organs and tissues, and external sources are water, aquatic plants, and bottom deposits. Dose power of radiation from artificial radionuclides is 2-3 orders smaller than radiation from natural sources in marine fish and about equal in river fish, while in lakes (especially in the presence of Cesium-137) the radiation of bottom fish from artificial sources is 5-10 times higher than from natural sources. In reservoirs contaminated by low-activity wastes dose power of radiation of fish from artificial radionuclides ranges 0.1-1-0 rad/day or higher. At all stages of ontogenesis chronic irradiation of sexual organs of fish with a dose power of 0.1-0.3 rad/day disrupts reproduction, and an increase to 1-3 rad/day causes more profound changes. Irradiated fish show reduced parasite and disease resistance. (See also W79-04537). (Lynch-Wisconsin)
W79-04543

A NON-STANDARD APPROACH TO HETEROTROPHY: ATP ESTIMATION OF NATURAL POPULATIONS OF SELECTIVELY-FILTERED BACTERIOPLANKTON AND THEIR GROWTH RATES ON IN-SITU WATER IN DIFFUSION-CULTURE,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
J. M. Sieburth, and D. M. Lavoie.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978. p 77-86. 3 fig, 2 tab, 16 ref. DES 74-01537.

Descriptors: *Bacterioplankton, *Adenosine triphosphate, *Dialysis, *Methodology, *Testing procedures, *Growth rates, *Biomass, Estimating, Research equipment, Diffusion, Cultures, Bacteria, Assay, Filtration, Substrates, Heterotrophy, Phytoplankton, Carbohydrates, Productivity, Plankton, Azores, Nutrients, Chlorophyll, Dissolved oxygen, Atlantic Ocean, Oceans.

A procedure for biochemical estimation of bacterioplankton biomass with adenosine triphosphate (ATP) assay, and a dirct method of estimating bacterioplankton growth rates and growth patterns in-situ with diffusion cultures are described; these methods are alternatives to direct microscopic counting for biomass and the indirect carbon-14 method for growth rate measurement. This paper reports experiments at a station east of the Azores in August 1975, part of a study conducted on a North Atlantic cruise. Bacterioplankton were isolated with Nuclepore membrane filters. ATP was extracted by immersion in boiling Tris (hydroxymethylaminomethane) buffer (pH 9.0 at 20 C) for two minutes and frozen until assayed aboard ship, using a luminescence biometer to measure luciferin-luciferase light reaction. A dialysis culture chamber was constructed using a 0.1-micrometer pore size Nuclepore membrane to retain the bacteria but allow diffusion of natural dissolved substrates and metabolic by-products. Vigorous agitation promoted solute transfer. Bacterioplankton biomass varied from 1.6-8.4 mg C/cu m over the uppermost 250 m, and its distribution strongly correlated with that of phytoplankton and dissolved carbohydrates. Bacterioplankton exposed to water pumped from 50 m (oxygen maximum) and 80 m (chlorophyll maximum) exhibited diurnal growth patterns from which daily production was estimated to be 20-67 mg C/cu m. The calculated mean annual production of 13 g C/cu m was about three times that obtained by other methods. (See also W79-04537). (Lynch-Wisconsin)
W79-04544

THE DEVELOPMENT OF STANDARD METHODS OF MEASURING MICROBIOLOGICAL PRODUCTION,
Moscow State Univ. (USSR). Dept. of Biology.
M. V. Gusev.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978. p 87-94.

Descriptors: *Microorganisms, *Bacteria, *Methodology, *Testing procedures, *Soviet Union, *Research priorities, *Productivity, Analytical techniques, Microbiology, Heterotrophy, Ecosystems, Ecology, Carbon radioisotopes, Photosynthesis, Chemical analysis, Staining, Chemostats, Limiting factors.

Three Soviet methods for determining microbial production are reviewed: (1) determining the increase in the number of bacteria in isolated water samples (Gak, 1975); (2) determination of microbe production by the radiocarbon method according to the rate of assimilation of carbon dioxide (Romanenko and Kuznetsov, 1974); and (3) determining potential microbial production to identify localization of active microbial populations and the effectiveness of bacterial biosynthesis in reservoirs. Research priorities for ecosystem characterization: (1) water chemical analysis, physico-chemical analysis, and makeup and number of microorganisms; (2) quantifying total microorganisms with filter staining, and number of living cells with luminescent microscopy; and (3) prediction of microorganism group abundance based on water composition and other factors using cultures on dense elective media. Priorities for determining true microbe production: (1) total production determination in isolated water samples with the Romanenko-Duznetsova-Sorokin method using carbon-14 with the rate of heterotrophic, chemosynthetic, and photosynthetic CO2-fixation; (2) determine water potential for microorganism production with chemostats; and (3) determine potential microorganism activity with limiting factors. (See also W79-04537). (Lynch-Wisconsin).
W79-04545

USE OF BIOLOGICAL INDICATORS FOR MONITORING EFFECT OF POLLUTANTS ON THE MARINE ENVIRONMENT,
Florida State Univ., Tallahassee. Dept. of Oceanography.
R. L. Iverson.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978, p 95-106. 61 ref.

Descriptors: *Bioindicators, *Bioassay, *Statistical methods, *Methodology, *Testing procedures, *Water pollution effects, *Oceans, Pollutants, Estuaries, Monitoring, Worms, Capitella, Fish, Mollusks, Algae, Phytoplankton, Zooplankton, Analytical techniques, Species composition, Sublethal effects, Chronicity effects, Toxicity, Poisons, Lethal limit.

Biological assay, indicator species, and biostatistical measures are discussed as means of assessing effects of pollutant on the marine environment. Boassay methodology has been developed for single species, and is under development for laboratory exerimental ecosystem bioassays. The bioassay approach is the primary means of predicting effects before pollutants are introduced into the marine environment, and will be important in monitoring sublethal effects on marine organisms. Indicator species (opportunistic species which colonize distrubed environments) are used to monitor after-the-fact pollution effects. The classical saprobic indicator system, based on zonal distribution of indicator organisms, is no longer used tin the U.S.; but some groups of organisms, such as capitellid worms, remain useful indiators of chronic pollution. Quantitative ecological techniques developed for characterizing assemblages of organisms show promise for monitoring pollutant effects. Although no single measure appears to be a conistent indicator of pollutant distrubance of natural aseembladges, a combination of dominance changes, species diversity, and evenness can be used with ordination methods to quanity changes in assemblages caused by pollutant stress or reduction of pollutant stress. Specific organisms used in bioassay and indicator species tests and problems of bioassay interpretation are discussed. (See also W79-04537). (Lynch-Wisconsin)
W79-04546

MICROORGANISMS AS BIOLOGICAL INDICATORS OF COMMERCIAL-DOMESTIC AND PETROLEUM POLLUTION,
Murmanskii Morskoi Biologicheskii Inst. (USSR).
I. B. Tokin, O. N. Trunova, and T. I. Izgoreva.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978, p 107-111. 4 tab, 3 ref.

Descriptors: *Bioindicators, *Microorganisms, *Water pollution effects, *Barents Sea, *Bacteria, *Bacteriophage, Domestic wastes, Municipal wastes, Oil pollution, Salmonella, Shigella, E. coli, Coliforms, Seas, Oxidation, Enterococci, Volumetric analysis, Water pollution sources, Pollutants, Self-purification, Viruses, Tidal effects, USSR.

The degree of pollution of two bays of the Barents SEa, U.S.S.R., by commercial-domestic and petroleum pollutants was measured by concentrations of microbioloical indicators: coliform bacteria, enterococci, petroleum-oxidizing microorganisms, and bacteriophages. Eighty samples representing varying degrees of pollution were taken from the most polluted bay, and 45 samples from a less-polluted bay. Results showed that the more polluted the water, the lower the solution level of sanitary-indicative microorganisms; a change in the solution level of commercial-domestic pollutant indicators correlated with the solution level of the petroleum-destroying microorganisms. In the first bay tests were carried out to relate the percentage of intestinal phages to the degree of pollution of the water by commercial-domestic organic material. The following cultures were used for phage ntrients: Escherichia coli, Shigella sonnei, Sh. Flexneri, Sal-

monella newland, and S. breslau. Without inoculation, which indicates the high concentration of phage-sensitive bacteria, only phages to E. coli, Sh. flexneri, and Sh. sonnei were isolated from polluted water samples with a solution level of .01. With inoculation, phages were isolated from all three categories of water samples, and the greatest percentage of phage isolation were those to E. coli and Sh. flexneri. Most phages were strictly species specific. In most phages colonies were circular. The tidal hydrological regime significnatly influenced self-purification. (See also W79-04537). (Lynch-Wisconsin)
W79-04547

PERSISTENCE LIMITS IN ECOLOGICAL SYSTEMS,
Environmental Research Lab., Narragansett, RI.
K. T. Perez.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978, p 112-117. 23 ref.

Descriptors: *Ecosystems, *Persistence, *Water pollution effects, *Pollution abatement, *Analytical techniques, *Methodology, Model studies, Computer models, Simulation analysis, Experimental ecosystem, Mathematical models, Laboratory tests, Theoretical analysis, Management, Persistence limits, Survival, Metals, Nutrients, Testing procedures, Ecology, On-site tests, Biological communities.

Determination of persistence limits of disturbed ecosystems on the basis of previous mathematical models, field studies, or laboratory studies seems either inappropriate or inconclusive. Laboratory simulations using experimental microcosms may be the most promising approach. A distrubed system is considered to persist as long as it will revert both structurally and functionally to its orginial state once the distrubance is relaxed. The persistence limit is defined as the distrubed state beyond which effets are irreversible. Persistence limits are a useful management tool since confining anthropogenic distrubances to those limits will insure maintenance of the system or resource. Constraints to these definitions: (1) the unperturbed system must be adequately defined in time and space, has holistic properties, and has multiple inherent stable points; (2) recovery time must be short relative to possible long-term natural changes in equilibrium states (about 1000 yrs); and (3) determination of system changes during distrubance is technology-dependent. Most computer simulation and analytical ecosystem models have been derived from components experimentally isolated from the system, and are therefore not suitable for establishing persistence limits. Field studies have been inconclusive. To date no attempts have been made to determine persistence limits for complex laboratory microcosms. (See also W79-04537). (Lynch-Wisconsin)
W79-04548

THE DEVELOPMENT OF STANDARD LABORATORY AND FIELD ECOSYSTEM RESEARCH TO DETERMINE THE EFFECTS OF POLLUTANTS ON THE MARINE ENVIRONMENT,
Moscow State Univ. (USSR). Dept. of Biology.
K. S. Burdin.
In: First American Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978, p 118-125. 1 tab, 11 ref.

Descriptors: *Methodology, *Experimental ecosystem, *Analytical techniques, *Laboratory tests, *On-site tests, *Oceans, *Water pollution effects, Environmental effects, Estuaries, Standard methods, Monitoring, Testing procedures, Ecosystems, Pollutants, Biological communities, Research priorities, Nutrients, Toxicity, Simulation analysis.

Research on effects of pollutants on the marine environment may be standardized by means of a proposed series of laboratory and field experiments, and by observing several rules in structuring research programs: (1) laboratory results must be used with caution in describing the condition of the entire ecosystem; (2) a parametric description of higher ecosystem levels does not necessarily also describe constituent components; (3) each level is described with a finite set of systemic parameters whosw measurement is interpreted according to a standard method; (4) standard research methods include a mandatory collection of test organisms cultured under standard conditions and with a detailed description of toxicological methods; (5) research programs must include experiments on various test species, on populations, and using simulated ecosystems (microcosms); (6) laboratory experiments are warrented only when pollution levels are known and effects cannot be established on the basis of ecosystem parameters. Suggested laboratory tests with 1-5 liter microcosms: (1) one or more populations in a chemostat, (2) pure population culture with a closed food cycle, (3) multiple reseedings to obtain a small portion of a natural ecosystem, (4) food chain organisms (including fish), and (5) simulation of all elements of the natural environment. Microcosms of various sizes may be used under field conditions. (See also W79-04537). (lynch-Wisconsin)
W79-04549

IMPACT OF PESTICIDES ON THE MARINE ENVIRONMENT,
Environmental Research Lab., Gulf Breeze, FL.
D. J. Hansen.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978, p 126-137. 4 fig, 4 tab, 20 ref.

Descriptors: *Pesticides, *Endrin, *Heptachlor, *Estuaries, *Water pollution effects, *Aquatic animals, *Bioassay, Oceans, Environmental effects, Minnows, Cyprinodon variegatus, Crabs, Shrimp, Lethal limit, Biological communities, Fish, Benthic fauna, Invertebrates, Florida, Methodology, Laboratory tests, Toxicity, Aroclors, Polychlorinated biphenyls, Toxaphene, Poisons, Pollutants, Testing procedures, Palaemonetes pugio.

Laboratory bioassay experiments were conducted to test effects of toxicants on estuarine animals: (1) acute bioassays with flowing water at constant salinity and temperature, and with measurement of toxicant concentation in water and test organisms and statistical analysis of mortality data; (2) bioassays on sensitive larval stages of crabs and shrimp; (3) bioassays over the reproductive period or entire life cycle of grass shrimp (Palacemonetes pugio) and sheepshead minnow (Cyprinodon variegatus); and (4) bioassays on communities of benthic macroinvertebrates. Bioassaying, perhaps the most useful technique available for predicting a chemical's potential hazard, includes acute toxicity experiments (either static or flow-through), usually used to determine the concentration of a chemical lethal to a certain percentage of test organisms over a short time; long-term bioassays on sensitive life stages, used to determine the concentration which can be tolerated by a species through all or part of its life cycle; and community bioassays, for predicting community response to a toxicant. Findings: (1) C. variegatus typically develops from embryo to maturity in 10-14 weeks with about 70% survival in the laboratory, females produce an average of eight eggs/day, and fertilization exceeds 90%; (2) the pesticides endrin and heptachlor reduced spawnings and eggs of C. variegatus, decreased egg fertility, and increased mortality of fry and spawning females. Effects of the pesticide toxaphene and the PCB Aroclor 1254 were also tested. (See also W79-04537). (Lynch-Wisconsin)
W79-04550

OIL AND MARINE ORGANISMS,
Institute of Biology of the Southern Seas, Sevastopol (USSR).
O. G. Mironov.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978, p 138-143. 1 tab, 6 ref.

Descriptors: *Oceans, *Water pollution effects, *Oil pollution, *Oil-oxidizing microorganisms, *Microorganisms, *Methodology, *Bioindicators, Testing procedures, Monitoring, Self-purification, Oil spills, Bacteria, Species diversity, Black Sea, Mediterranean Sea, Seas, Organic compounds.

A relatively low-cost international program for monitoring petroleum-oxidizing microorganisms as indicators of oceanic hydrocarbon pollution is described, based on Soveity investigations in the Back and Mediterranean Seas. The program, which would cost about $5 million for equipment and laboraotry processing of the initial 100 samples, was first presented to the Joint Study of the Mediterranean Sea (JSMS) in 1975. For the minimum program (first stage), the population of hydrocarbon-oxidizing microorganisms in mineral media would be determined with a single source of carbon and energy (crude petroleum and simple phenol) by the method of maximum dilutions on the surface layer, the surface layer plus standard levels and in the surface layer plus standard levels plus the seabed. Test bodies of water would include periodic profiles within a country's territorial waters, permanent coastal stations, expeditions outside the coastal zone, etc. Observations could vary from daily to weekly or monthly. The second stage provides for the isolation of the microorganisms and determination of their hydrocarbon-oxidizing acitivity, permitting calculations of the ocean's capacity for self-purification and prediction of pollution extent. Some of these studies have already begun. Effects of oil pollution are discussed. (See also W79-04537) (Lynch-Wisconsin)
W79-04551

IMPACT OF METALS ON THE MARINE ENVIRONMENT,
Moss Landing Marine Lab., CA.
J. H. Martin.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978, p 144-154. 43 ref.

Descriptors: *Oceans, *Heavy metals, *Water pollution effects, *Experimental ecosystems, *Toxicity, Mercury, Selenium, Sea water, Copper, Pollutants, Sea lions, Zalophus californianus, Trace elements, Zooplankton, Phytoplankton, Algae, CEPEX program, Research priorities, Public health, Methodology, Abalone.

Research on heavy metal pollution of the marine environment is still inconcluive although elevated cocentrations of heavy metals have been ecountered in some organisms. However, the threat to human health has been well-documented in cases of mass mercury poisonings in minamatta, Japan, and in Iraq, and cadmium and lead are known human health hazards. Mass mortalities caused by heavy metals have been observed in the marine environment, though they are rare compared with land occurrences. All abalone in a discharge area were killed by elevated copper concentrations in contaminated power plant cooling water. The Controlled Ecosystem Pollution Experiment (CEPEX) program was undertaken to meet the need for tests with realistic levels of various pollutants rather than the high levels generally used in small-scale laboratory experiments. some 70 tons of seawater were enclosed in polyethylene bags placed in Saanich Inlet, Vancouver, British Columbia. In early experiments copper concentrations of one ppb inhibited Chlorella growth and photosynthesis. Photosynthesis in the freshwater diatom Nitzchia palea was also inhibited ata that level. Interactions of metals and organisms are extremely complex and difficult to isolate. (See also W79-04537). (Lynch-Wisconsin)
W79-04552

REPORT OF THE JOINT AMERICAN-SOVIET EXPEDITION ON THE SCIENTIFIC RESEARCH VESSEL 'MOSCOW UNIVERSITY' FOR THE FIRST STAGE OF INTERCALIBRATION OF METHODS FOR THE HYDROBIOLOGICAL ANALYSIS OF AQUATIC ECOSYSTEMS,

Florida State Univ., Tallahassee. Dept. of Oceanography.

R. L. Iverson, K. C. Burdin, V. Maximov, and M. Lymin.

In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978, p 156-165. 1 fig, 1 tab, 9 ref.

Descriptors: *International cooperation, *Methodology, *Carbon radioisotopes, *Primary productivity, *Phytoplankton, *Oceans, *Soviet Union, *United States, Hydrobiology, Ecosystems, Atlantic Ocean, Gulf of Mexico, Gulfs, Liquid scintillation, Sampling, On-site tests, Filters, Measurement, Volumetric analysis, Algae, Testing procedures, Analytical techniques, Regression analysis.

American and Soviet methods for measuring phytoplankton productivity were compared during an expedition aboard a research ship in the western Atlantic Ocean and eastern Guld of Mexico in summer 1975, and no consistent difference in carbon-14 activity was found except at one station. At station 9, Synpor membrane filters with a 0.3-micron pore size were used by both Soviet and American researchers (the Americans normally used 24-mm diameter Whatman GF/C glass fiber scintillation grade filters), and American activity was consistently lower than Soviety activity at all depths, suggesting it is necessary to solubilize the Synpor filters in order to minimize radioisotope absorption problems. Anomalously high activity values (e.g. Soviet station 3, and American station 7) were usually characterized by high standard deviations reflecting effects of high activity values for one or two of the three replicate samples; these high values are unexplained, but may result from uneven distribution of phytoplankton between repliates or from problems in correcting for chemiluminescence. Mean coefficient of variation for American carbon-14 activity values was 21 (range 2-123), while Soviet mean was 29 (0-145). Integrated productivity values for each station were treated by linear regression. The regression slope of American Soviet values was not significantly different from 1.0 ($p=0.05$) and the intercept was not significantly different from 0.0 ($p=0.05$), indicating the two sets of methods gave similar values. (See also W79-04537). (Lynch-Wisconsin)
W79-04553

DISTRIBUTION OF STABLE ORGANIC MOLECULES IN THE MARINE ENVIRONMENT: PHYSICAL CHEMICAL ASPECTS. CHLORINATED HYDROCARBONS,

URS Co., Seattle, WA.

R. N. Dexter, and S. P. Pavlou.

Marine Chemistry, Vol 7, No 1, p 67-84, December 1978. 3 fig, 3 tab, 60 ref.

Descriptors: *Water pollution, *Chlorinated hydrocarbons, *Organic compounds, *Environmental effects, Chemical analysis, Pollutant identification, Resources development, *Outer continental shelf, Physical chemistry.

The relative concentrations of non-polar organic compounds in seawater and suspended particulate matter can be explained by an equilibrium sorption mechanism. The value of the quasi-equilibrium constant, K, was calculated with reasonable accuracy for polychlorinated biphenyls from a relatively simple equation which relies on both measurable physical parameters and a number of molecular terms estimated from fundamental physical chemical considerations. This model represents an approach to defining the accumulation of stable organic molecules on marine particulate interfaces within a coherent theoretical framework. As such, it provides a guide for selecting appropriate ecosystem parameters which influence the distribution and accumulation potential of these chemicals in the marine environment. (Sinha-OEIS)
W79-04559

VOLATILE LIQUID HYDROCARBONS IN THE SURFACE COASTAL WATERS OF THE GULF OF MEXICO,

Texas A and M Univ., College Station. Dept. of Oceanography.

T. C. Sauer, Jr., W. M. Sackett, and L. M. Jeffrey.

Marine Chemistry, Vol. 7, No. 1, p 1-16, December 1978. 5 fig, 3 tab, 53 ref.

Descriptors: *Water pollution, *Chemical analysis, *Pollutant identification, *Environmental effects, Gulf of Mexico, Coasts, Dispersion, Evaporation, *Outer Continental shelf, Hydrocarbons, Petroleum hydrocarbons.

A sampling and analysis procedure has been developed to determine quantitatively volatile liquid C6-C14 hydrocarbons, the most immediately toxic components of petroleum hydrocarbons, at the ng/l level characteristically found in marine waters. The method involves dynamic headspace sampling; continuous stripping of volatile hydrocarbons from heated seawater by an ultrapure inert gas, and trapping of volatile components on a solid polyphenyl ether adsorbent, Tenax-GC. Distributions of liquid hydrocarbons were determined in coastal surface waters of the Gulf of Mexico. Total volatile n-alkane concentrations range from 7 ng/l to 50 ng/l, whereas total volatile aromatics (benzene, toluene, ethylbenzene and xylenes) range from 20 ng/l to 450 ng/l. At most sample stations, 80-90% of the total liquid hydrocarbons in surface water is aromatic. The contribution in seawater of these volatile hydrocarbons to the total solvent-extractable hydrocarbon budget is a few percent at most. A direct correlation exists between liquid hydrocarbon concentrations and C1-C5 hydrocarbon concentrations. Surface-water samples which show high liquid hydrocarbon concentrations (500 ng/l) are also extremely high in methane and ethane relative to open-ocean levels. Samples which are lowest in liquid hydrocarbons (30 ng/l) have concentrations of methane and ethane close to baseline or open-ocean concentrations. (Sinha - OEIS)
W79-04560

LES PAPETERIES DU BOURRAY (FRANCE), AN EXAMPLE OF EFFECTIVE TREATMENT OF WASTE WATERS (LES PAPETERIES DU BOURRAY, UN EXEMPLE D'EPURATION EFFICACE DES EAUX RESIDUAIRES),

ATIP (Association Technique de l'Industrie Papetiere) Revue, Vol. 32, No. 4, p 156-159, April, 1978. 6 illus.

Descriptors: *Pulp wastes, *Waste water treatment, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Flocculation, Sedimentation, Sludge treatment, Dewatering, Suspended solids, Treatment facilities, Foreign countries, France, Europe, Clarifiers.

A description is given of the effluent treatment system installed at the Bourray paper mill, which manufacturers mainly writing and printing papers and cellulose wadding from hemp and waste paper raw materials. The system features a clarifier combining flocculation with sedimentation and sludge thickening. In 1977, the station received an average of 10,000 cu m of waste water/day containing 5,000 kg of suspended solids. The concentration of suspended matter in the clarified effluent averages 8 mg/liter (0.9 kg/ton of paper produced). No addition of chemicals is required. Recycling of the clarified water is planned for the future. (Speckhard-IPC)
W79-04561

KINETIC ANALYSIS OF INTERACTIVE EFFECTS OF CADMIUM AND NITRATE ON GROWTH OF THALASSIOSIRA FLUVIATILIS (BACILLARIOPHYCEAE),

Dalhousie Univ., Halifax (Nova Scotia). Dept. of Oceanography.

For primary bibliographic entry see Field 5A.
W79-04587

EFFECTS OF HEAVY METALS ESPECIALLY SELENIUM, VANADIUM AND ZIRCONIUM ON MOVEMENT, GROWTH AND SURVIVAL OF CERTAIN ANIMAL AQUATIC LIFE,

Kansas Water Resources Research, Manhattan.

E. C. Bovee.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 563, Price codes: A03 in paper copy, A01 in microfiche. Project Completion Report, 1978. 26 p, 11 fig, 15 ref. OWRT B-051-KAN(1). 14-34-0001-7159.

Descriptors: *Heavy metals, Protozoa, Bioassay, *Selenium, *Vanadium, *Zirconium, Tetrahymena, Growth rates, Swimming rates.

The heavy metals Selenium (as H_2SeO_3 and as Na_2SeO_3), Vanadium (as $VOSO_4.2H_2O$) and Zirconium (as $ZrOCl_2.xH_2O$) were tested for potential toxicity to the growth and swimming rates of the ciliated protozoan, Tetrahymena pyriformis. Vanadium and Zirconium, as used, were less toxic in small amounts than some other metals previously tested, e.g., Cadmium. Neither inhibited growth significantly at amounts below five parts per million (5 ppm). Selenium as selenous acid (H_2SeO_3) slightly stimulated growth at 5 to 15 ppm; but as selenite (Na_2SeO_3) it completely blocked growth at all concentrations tested, 3 to 20 ppm. Vanadium did not affect growth at 3 to 15 ppm, but depressed it in greater amounts. Zirconium at concentrations of 3 to 15 ppm slightly stimulated growth, but depressed it at higher amounts. All three metals, however, inhibited swimming at concentrations over 5 ppm, selenium being the more toxic, stopping swimming in 30 ppm in less than 1 hour. Concentrations of any of the three metals above 20 ppm are detrimental to the growth and survival of Tetrahymena pyriformis. The methods used for analyzing growth and swimming rates are qualitatively useful to detect a dangerous level of a pollutant and the photographic method for analyzing swimming rates may also be a useful quantitative assay for a known pollutant, as well as being a rapid, inexpensive bioassay.
W79-04592

EFFECTS OF LEAD ON GROWTH OF THE MARINE DIATOM SKELETONEMA COSTATUM,

City Coll., New York. Dept. of Biology.

R. B. Rivkin.

Marine Biology, Vol. 50, p 239-247, 1979. 1 fig, 5 tab, 62 ref.

Descriptors: *Growth rates, *Diatoms, *Lead, Toxicity, Heavy metals, Cytological studies, Respiration, Photosynthesis, Chlorophyll, Proteins, Aquatic algae, Carbon, Biochemistry, *Skeletonema, Bioaccumulation.

The growth rate and maximum yield of Skeletonema costatum in batch culture were inhibited by dissolved lead at concentrations of 0.05 to 10.0 micrograms Pb l-1. Growth rate, maximum yield, and respiration cell-1 decreased and photosynthesis cell-1 and cell volume increased in response to increased lead concentration in the medium. At 0.1 and 1.0 microgram Pb 1-1, the chlorophyll a:carbon and protein:carbon ratios did not significantly differ from the control and the increased cellular chlorophyll a, carbon and protein observed at these concentrations reflect an increased cell volum. However, at 10.0 micrograms Pb1-1, associated with an increase in cell volume, the chlorophyll a:carbon ratio was significantly lower and the protein:carbon ratio was significantly higher than in the control, reflecting a changes cellular chemical composition. The rates of cell division and dark respiration decreased relative to photosynthesis and to carbon and protein production, resulting in an alteration of the cellular chemical composition. (DEAL-EIS)
W79-04600

REQUIREMENT OF RAINBOW TROUT FOR DIETARY MAGNESIUM, (IN JAPANESE),
Tokyo Univ. of Fisheries (Japan). Lab. of Fish Nutrition.
C. Ogino, F. Takashima, and J. Y. Chiou.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 4, No. 10, p 1105-1108, 1978. 8 fig, 4 tab, 5 ref. (English abstract).

Descriptors: *Nutrient requirements, *Rainbow trout, *Fish diets, *Magnesium, *Calcium, Nutrients, Laboratory tests, Diets, Growth rates, Fish behavior, Pathology, Microscopy, Trout, Salmonids, Fish farming, Aquiculture, Commercial fish, Fish management, *Salmo gairdneri, Histology.

Rainbow trout weighing 0.9 g on the average were fed purified diets containing different amounts of Mg for 6 weeks. The concentration of Mg in the rearing water was 3.1 ppm. Dietary Mg levels were found to affect not only the appetite, growth, and movement of the fish but also the contents of ash, Mg, and Ca of the whole body and of the vertebrae. The occurrence of vertebral curvature was also recognized in the fish which received the Mg-dificient diet. The values for Ca/Mg of the whole body and of the vertebrae changed according to the dietary Mg levels. Histological changes were recognized in the muscle, pyrolic caeca, and gill filaments from the fish fed the Mg-deficient diet. The requirement of rainbow trout for dietary Mg was estimated to 0.06-0.07% of a dry diet or 12-16 mg per 1 kg body weight per day under the present experimental conditions. (Katz-EIS)
W79-04601

THE INFAUNAL BENTHOS OF A NATURAL OIL SEEP IN THE SANTA BARBARA CHANNEL,
California Univ., Livermore. Lawrence Livermore Lab.
For primary bibliographic entry see Field 5B.
W79-04624

EFFECT OF ENRICHMENT WITH DIGESTED NIGHT SOIL ON THE GROWTH OF MARINE PLANKTON (IN JAPANESE),
Yamanashi Univ., Kofu (Japan). Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5B.
W79-04626

NO. 2 FUEL OIL DECREASES EMBRYONIC SURVIVAL OF GREAT BLACK-BACKED GULLS,
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.
N. C. Coon, P. H. Albers, and R. C. Szaro.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 152-156, 1979. 2 tab, 11 ref.

Descriptors: *Oil, *Mortality, *Gulls, *Bird eggs, Oil spills, Oil pollution, Organic compounds, Clutch, Nests, Water birds, Toxicity, Incubation, Hatching, Bioassay.

Two concurrent studies are reported in which eggs of the great black-backed gull were externally contaminated with No. 2 fuel oil. In the first experiment, performed entirely in the wild, 90 clutches of eggs were randomly assigned to three groups. Two groups were treated with either 5 microliters or 20 microliters of No. 2 fuel oil. The third group served as the control. The clutches treated wth 20 microliters of oil per egg had significantly poorer survival rate at 8 days post treatment than the control clutches. Survival rate did not differ between control and 5 micro-liter-treated clutches. The second experiment consisted of the same three threatment groups, except it was performed on laboratory-incubated eggs. There was significantly more mortality in both the 20 and 5 microliter-treated groups at the end of 18 days as compared to controls. This artificial incubation bioassay is useful in predicting the effects of environmental contaminants on bird productivity. (DEAL-EIS)
W79-04628

INCREASED SPONTANEOUS LOCOMOTOR ACTIVITY IN THE FIDDLER CRAB, UCA PUGILATOR, AFTER EXPOSURE TO A SUBLETHAL CONCENTRATION OF DDT,
Tulane Univ., New Orleans, LA. Dept. of Biology.
S. W. Fingerman, C. V. Meter, Jr., and M. Fingerman.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 11-16, 1979. 2 fig, 8 ref.

Descriptors: *DDT, *Crabs, *Animal behavior, Chlorinated hydrocarbon pesticides, Biorhythms, Insecticides, Pesticide residues, Pesticide toxicity, Chemical properties, Animal physiology, Temporal distribution, Circadian rhythm.

The objectives were to determine the effect of DDT on the level spontaneous locomotor activity throughout a 24 hr day and whether DDt alters the circadian pattern of this activity. Crabs were exposed to 0.08ppm DDT for three days. DDT produced an increase in the spontaneous locomotor activity of these fiddler crabs. The circadian nature of their activity appeares not to have been affected. (Deal-EIS)
W79-04629

BIOSOLIDS AS FOOD,
Institute of Paper Chemistry, Appleton, WI.
E. F. Zanella.
In: Proceedings of The Institute of Paper Chemistry (Appleton, Wisconsin) 42nd Executives Conference, May 10-11, 1978. p 28-31, 2 fig.

Descriptors: *Pulp wastes, *Foods, *Aquatic microorganisms, Suspended solids, Wastes, Industrial wastes, Digestion, Caddisflies, Daphnia, Aquatic life, Biological treatment, Waste water treatment, Pulp and paper industry, Effluents, Aquatic insects, Path of pollutants.

Experimental techniques are discussed for demonstrating the ingestion and assimilation of nonsettleable solids in pulp and paper mill effluents by aquatic organisms. Mill biosolids supported the growth of large caddis fly (Hydropsyche walkeri) larvae and both the growth and reproduction of Daphnia. Thus, the discharge of biosolids to receiving streams may have a beneficial or at least neutral effect on the animal life, and for this reason it is felt that solids which can be used as food may not warrant removal by expensive and complicated waste treatment beyond current levels of secondary biological treatment. (Brown-IPC)
W79-04638

RESPONSE OF EURYTHERMAL AND STENOTHERMAL FISH SPECIES TO CHLORINATED DISCHARGES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology; and Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
For primary bibliographic entry see Field 5B.
W79-04651

A COMPUTER MONITORED AQUATIC BIOASSAY SYSTEM,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W79-04652

ON THE ESTIMATION OF THE ANTHROPOGENIC POLLUTION EFFECT ON THE FUNCTIONAL STATE OF THE SOIL MICROFLORA,
Institute of Experimental Meteorology, Obninsk (USSR).
E. I. Gaponyuk, and V. A. Kobzev.
In: Symposium on Environmental Transport and Transformation of Pesticides, October, 1976, Tbilis, USSR. EPA-600/9-78-003, p 86-97, February, 1978. 2 fig, 2 tab, 13 ref.

Descriptors: Industrial wastes, Agricultural chemicals, Pesticides, *Pesticide toxicity, *Soil microorganism, Soil microbiology.

Experiments were conducted in Russia to estimate the anthropogenic pollution effect on the functional state of the soil microflora. The dehydrogenase activity was chosen as a criterion for evaluating the effect of industrial and agricultural toxicants on the biological activity of soil microflora. The toxic effect of high concentrations of heavy metals in soils of industrial regions was found to be greater than that of pesticides. The experimental results indicate that the toxic effect of chlororganic pesticides on the soil microflora may be accounted for by the disturbance of the dehydration processes which are of energetic value for the cell. And the decrease in the dehydrogenase activity may lead to a decrease in the biotransformation processes associated with it. (Skogerboe-Colorado State)
W79-04657

RESEARCH ON PULP AND PAPER INDUSTRY WATER AND EFFLUENT QUALITY PROBLEMS -- A REVIEW,
British Columbia Research Council, Vancouver.
C. C. Walden, T. E. Howard, and J. C. Mueller.
In: Canadian Pulp and Paper Association Technical Section, Spring Conference, May 17-21, 1978, Jasper, Alberta, Preprinted Proceedings, p. 55-64. 5 fig, 4 illus, 58 ref, 3 tab.

Descriptors: *Water quality, *Pulp and paper industry, *Water pollution effect, Wastes, Industrial wastes, Water pollution sources, Pulp wastes, Fish, Aquatic animals, Aquatic life, Toxicity, Biological treatment, Foam fractionation, Separation techniques, Suspended solids, Environmental effects, Color, Microbiology, Aquatic microbiology, Canada, Foreign countries, Waste water treatment, Water pollution treatment, Detoxification.

Since 1966 the British Columbia Council of Forest Industries and North Western Pulp and Power Ltd. (Alberta) have sponsored research programs in water quality problems. These programs are outlined. They concern the sublethal impacts of kraft effluents on fish. The removal of effluent toxicity by biological treatment and foam fractionation, the formation and environmental impact of suspended solids, the microbiological characteristics of pulp mill effluents, the environmental impact of color, and in-plant toxicity studies and avoidance. (Swichtenberg-IPC)
W79-04668

DISSOLVED OXYGEN DEMAND OF REDUCED CHEMICAL SPECIES IN THE WATER COLUMN OF SEBASTICOOK LAKE, MAINE,
Maine Univ. at Orono.
For primary bibliographic entry see Field 2H.
W79-04684

STUDIES ON THE POST-MORTEM IDENTIFICATION OF THE POLLUTANT IN FISH KILLED BY WATER POLLUTION - XIII CADMIUM (IN JAPANESE),
Tohoku Univ., Sendai (Japan). Dept. of Fisheries.
For primary bibliographic entry see Field 5A.
W79-04694

COMPARISON OF A HIGH VOLUME PUMP AND CONVENTIONAL PLANKTON NETS FOR COLLECTING FISH LARVAE ENTRAINED IN POWER PLANT COOLING SYSTEMS,
Lockheed Center for Marine Research, Carlsbad, CA.
For primary bibliographic entry see Field 5A.
W79-04703

ECONOMICS OF ON-FARM METHODS OF CONTROLLING SEDIMENT LOSS FROM SURFACE-IRRIGATED FIELDS,
For primary bibliographic entry see Field 4D.
W79-04756

PRODUCTS OF PHOTOSYNTHESIS IN NATURAL POPULATIONS OF MARINE PHYTOPLANKTON FROM THE GULF OF MAINE,

Bigelow Lab. for Ocean Science, West Boothbay Harbor, ME.
I. Morris, and W. Skea.
Marine Biology, Vol. 47, No. 4, 303-312, 1978. 9 fig, 26 ref. NSF DES75-15104, ERDA AT (11-1) 3024.

Descriptors: *Phytoplankton, *Marine algae, *Atlantic Ocean, *Carbon radioisotopes, *Photosynthesis, Gulf of Maine, Algae, Maine, Proteins, Photosynthetic products, Eutrophication, Darkness, Light intensity, Seasonal, Depth, Carbon dioxide, Methodology, Biochemistry, Oceans, Polysaccharides, Analytical techniques, Trichloroacetic acid, Boothbay Harbor(ME).

Measurements were made of photosynthetic assimilation of carbon-14 carbon dioxide by natural marine phytoplankton populations at three sites in the Atlantic Ocean off the northeastern U.S. coast (Gulf of Maine) into: (1) ethanol-soluble, (2) hot-trichloroacetic acid (TCA)-soluble (polysaccharide), and (3) protein fractions. Diurnal studies were conducted 1975 at Jeffery's Ledge and Great South Channel, and a seasonal study 12 km south of Boothbay Harbor, Maine. Diurnal studies showed continuing incorporation of carbon-14 into the protein fraction in darkness, accompanied by a decrease in the proportion assimilated into polysaccharide. Photosynthesis pattern did not vary by time of day. At the station south of Boothbay Harbor, marked seasonal changes occurred in the proportion of carbon entering protein; in winter about 10-20% of fixed carbon was incorporated, while in summer it was 22-35%. During spring bloom a transient high value of 37-47% occurred. The proportion of carbon incorporated during photosynthesis increased markedly at reduced light intensities, both when populations were incubated with neutral-density filters and at increasing depths in the photic zone. The increased relative rate of protein synthesis at lower light intensities depended on the nutrient state of the phytoplankton. (Lynch-Wisconsin)
W79-04763

THE BIOLOGY, ECOLOGY, AND BEHAVIOR OF THE BIVALVE MYSELLA BIDENTATA (MONTAGU),

K. W. Ockelmann.
Ophelia, Vol. 17, No. 1, p 1-93, July 1978. 20 fig, 10 tab, 87 ref.

Descriptors: *Mysella bidentata, *Amphiura filiformis, *Bivalves, *Life history studies, *Growth stages, *Reproduction, Amphiura chiajei, Symbiosis, Scandinavia, Mollusks, Marine biology, Ecology, Behavior, Classification, Monticutidae, Invertebrates, Benthic fauna, Ophiuroidea, Echinoderms, Oresund, Atlantic Ocean, Oceans, Distribution, Clams, Mortality, Predation, Fertility, Morphology, Model studies, Straits.

Behavior, reproduction, spatial distribution, growth, mortality, feeding, and functional morphology of the boreal-lusitanian east Atlantic bivalve Mysella bidentata (3.1-3.9 mm) are described, with information on the ophiuroid echinoderm Amphiura M. bidentata distribution positively correlates with adult A. filiformis density in the northern Oresund between Denmark and Sweden. In the laboratory the euryvalent M. bidentata prefers to live in oxidized layers around the burrow of Amphiura. Dense Amphiura populations enlarge the water-sediment interface and thereby the oxidized layers and microbial activity, benefitting Mysella which obtains protection from surface-hunting predators and additional food supply. The bivalves are functional males in their second year, and at three years and three mm long they are hermaphrodites. Males produce fertile and oligopyrene sperm simultaneously; as sperm transfer involves sperm bags and receptacula seminis, it is time-independent of egg spawning. Mysella reacts to gravitation by positive or negative body movement and to direction of water flow by positive turning movement. Chemical stimuli from a predator, Astropecten, evoke direct orthokinesis, while stimuli from the host Amphiura evoke direct orthokinesis and direct klinokinesis. A model, adaptable to other species, links responses and behavioral patterns in Mysella to physiological functions, survival mechanisms, site selection, and intraspecific regulation. (Lynch-Wisconsin)
W79-04764

ASPECTS OF WATER COLUMN PRIMARY PRODUCTIVITY IN THE CHUKCHI SEA DURING SUMMER,

Science Applications, Inc., Boulder, CO.
M. J. Hameedi.
Marine Biology, Vol. 48, No. 1, p 37-46, 1978. 2 fig, 1 tab, 44 ref. Wash. U., Applied Physics Lab. NR 307 357. U.S. Navy N00014-75-C-0187.

Descriptors: *Chukchi Sea, *Primary productivity, *Summer, *Chlorophyll, *Phytoplankton, *Arctic Ocean, Oceans, Seas, Cold regions, Alaska, Siberia, Solar radiation, Limiting factors, Nitrogen, Phosphorus, Silicates, Phosphates, Nutrients, Salinity, Water temperature, Equations, Shade, Algae.

Phytoplankton productivity, chlorophyll distribution, and related processes during July 1974 in the marginal ice zone of the Chukchi Sea north of the Bering Straits in the Arctic Ocean showed low to moderate primary productivity levels (0.07-0.97 g C/sq m/half-day), and nitrogen-limited surface primary productivity at most stations. Primary productivity exceeded three g C/sq m/half-day at two stations. Mean chlorophyll-a concentration in the photic zone varied 0.4-17.8 mg/cu m. In July, higher concentrations of chlorophyll-a, reaching 40 mg/cu m, were observed at stations near the ice-edge than in open water, along with significant subsurface accumulation. No chlorophyll maximum was noted in September, when values ranged 0.4-2.2 mg/cu m. The contribution of sea-ice algae to total chlorophyll content may be substantial, but these cells may not remain long in the water column. Nonlinear regression estimates from solar radiation and chlorophyll-specific primary productivity data showed a maximal photosynthetic rate of 18 mg C/mg chlorophyll-a/half-day, an optimal light intensity of 54 langleys/half-day, and markedly reduced primary productivity at moderately higher light intensities, indicating shade-adaptation by phytoplankton. The two equations used to describe the photosynthesis-light relationships (by Steele and Vollenweider) described the data well, though the Vollenweider equation underestimated the observed specific photosynthesis by a small but significant amount. (Lynch-Wisconsin)
W79-04765

STUDIES ON 14CO2-ASSIMILATION IN MARINE RHODOPHYCEAE,

Cologne Univ. (Germany, F.R.). Botanisches Inst.
B. P. Kremer.
Marine Biology, Vol. 48, No. 1, p 47-45, 1978. 7 fig, 30 ref.

Descriptors: *Rhodophyceae, *Carbon dioxide, *Photosynthesis, *Assimilates, *Photocynthetic products, *Biochemistry, Algae, Marine algae, Enzymes, Darkness, Carbon radioisotopes, Kinetics, Carbon, Porphyra umbilicalis, Rhodomela confervoides, Corallina officinalis, Chorndrus crispus, Gigartina stellata, Rhodymenia palmata, Delesseria sanguinea, Ceramium rubrum, Polysiphonia urceolata, Ribulose-1,5-diphosphate carboxylase, Floridoside.

Nine marine species of Rhodophyceae belonging to different orders were used in studies of carbon-14 carbon dioxide assimilation and kinetics of carbon-14 labelling of typical assimilates. Purposes were to: (1) determine the biosynthesis of the assimilates in reaction to CO2-fixation, (2) evaluate their biochemical significance, and (3) compare their function with the low-molecular weight assimilates of other algal classes. Results showed that carbon assimilation in Rhodophyceae is almost exclusively performed by photosynthesis via ribulose-1,5-di-phosphate carboxylase, whereas light-independent (dark) CO2-fixation via beta-carboxylation by phosphoenolpyruvate carboxykinase scarcely exceeds 1% of the total carbon fixation potential of the plants. Activity of phosphoenolpyruvate carboxylase could not be detected. The species were not uniform with respect to the main accumulation products of photosynthesis CO2-fixation; Corallina officinalis, Rhodymenia palmata, and Gigartina stellata accumulated carbon-14 in the neutral compound floridoside, whereas Delesseria sanguinea, Ceramium rubrum, and Rhodomela confervoides (representing the Delesseriaceae, and Rhodomelaceae) do not photosynthesize floridoside, but show intense carbon-14 labelling in an acidic constituent, mannosidoglycerate, also reported for the first time as a rapidly carbon-14 labelled and accumulated photosynthate in several species belonging exclusively to the Ceramiales. Other species studied were Porphyra unbilicalis, Chondrus crispus, and Polysiphonia urceolata. (Lynch-Wisconsin)
W79-04766

LIFE CYCLES AND POPULATION DYNAMICS OF MARINE BENTHIC BIVALVES FROM THE DISKO BUGT AREA OF WEST GREENLAND,

Zoologisk Museum, Copenhagen (Denmark).
G. H. Petersen.
Ophelia, Vol. 17, No. 1, p 95-120, July 1978. 18 fig, 6 tab, 17 ref.

Descriptors: *Bivalves, *Disko Bugt(Greenland), *Life cycles, *Population dynamics, *Life history studies, Greenland, Productivity, Biomass, Energy, Reproduction, Parasitism, Seasonal, Settling, Benthic fauna, Faunal lists, Mollusks, Analytical techniques, Suspension feeders, Deposit feeders, Ecology, Mytilus edulis, Serripes groenlandicus, Macoma balthica, Macoma calcarea, Nucula tenuis, Cardium ciliatum, Hiatella byssifera, Mya truncata.

Eight of 24 bivalve species collected 1958-60 in the Disko Bugt area of west Greenland were studied with regard to life cycles and population dynamics: Nucula tenuis, Mytilus edulis, Serripes groenlandicus, Cardium ciliatum, Macoma calcarea, M. balthica, Hiatella byssifera, and Mya truncata. Distribution and abundance of all 24 species are presented in a table. Biomass and production were highest for suspension feeders in a shallow, exposed locality, and almost negligible in a deep, sheltered locality, where deposit feeders predominated. Samples were collected from the exposed shell gravel locality Udkiggen (80-100 m) and from four Godhavn sites: (1) Godhavn Havn, 3-13 m (exposed, shallow); (2) Lyngmarksbugt, 25-42 m (exposed, deep); (3) Fangsthytten, 3-18 m (sheltered, shallow); and (4) Tut, 80-107 m (sheltered, deep). In all about 15,000 specimens were collected with a 0.1-sq m van Veen grab. Weight of gonad output was estimated at 1-5% of biomass, and the weight of the settling larvae was about twice the weight of the recruitment to age I. Differences in biomass and production between the localities is the result of gains and losses of energy for the subpopulations at each locality. Favorable factors for growth and production include high food supply, low temperature, and hydrodynamic forces utilizable for food uptake and respiration. Several cases of parasitism were recorded. (Lynch-Wisconsin)
W79-04767

NOTES ON FRESHWATER RED ALGAE FROM WEST MALAYSIA,

Kobe Univ. (Japan). Dept. of Biology.
S. Kumano.
The Botanical Magazine Tokyo, Vol. 91, No. 1022, June 1978. p 97-107. 7 fig, 22 ref.

Descriptors: *Malaysia, *Rhodophyta, *Classification, *Swamps, *Rivers, *Algae, *Systematics, Ballia pinnulata, Batrachospermum beraense, Batrachospermum cylindrocellulare, Batrachospermum tortuosum, Batrachospermum vagum, Caloglossa ogasawaraensis var. latifolia, Tuomeya gibberosa, Hildenbrandia rivularis, Sirodotia delicatula, Tasek Bera(Malaysia), Gombak River(Malaysia), Cherok River(Malaysia), Semai River(Malaysia), Marong Kanan River(Malaysia), Lake Bera(Malaysia), Brackish water, Cytological studies, Floral lists.

Nine species of freshwater red algae were collected 1970-73 in western Malaysia as part of a joint Malaysia-Japan project; five species and one variety are described as new taxa, and three are first records for Malaysia. New taxa are Ballia pinnulata, Batrachospermum beraense, B. cylindrocellulare, B. tortuosum, Caloglossa ogasawaraensis var. latifolia, and Tuomeya gibberosa. New Malaysian records are Batrachospermum vagum, Hildenbrandia rivularis, and Sirodotia delicatula. The algae were collected chiefly in three types of water: (1) brackish water (Tasek Bera, a swamp in northern Paghang), (2) white water (Marong Kanan, a small rivulet running through the virgin Pasoh Forest Reserve in northern Negeri Sembilan), and (3) clear water (the Gombak River, running from a mountain ridge to the vicinity of Kuala Lumpur, and the Cherok and Semai Rivers, branches of the Balong Padang River. Materials were preserved either dried from herbarium specimens or preserved in 10% formalin and in aceto-alcohol solutions for cytological studies. Water pH values were determined by a colorimetric method. The Tasek Bera, surrounded by virgin swamp forests, comprises a series of marshes separated by small swamps but interconnected by narrow rivulets; its water is dark brown, and ranges 23.8-26.9 C and 4.7-5.3 pH. Water temperature of the Marong Kanan was 24.7 C in April 1971. The three clear-water rivers were 23-26 in May-June, and 6.8-6.9 pH. (Lynch-Wisconsin)
W79-04768

VARIABILITY IN ZOOPLANKTON BIOMASS DISTRIBUTION IN THE NORTHERN SARGASSO SEA: THE CONTRIBUTION OF GULF STREAM COLD CORE RINGS,
Woods Hole Oceanographic Institution, MA.
P. B. Ortner, P. H. Wiebe, L. Haury, and S. Boyd.
Fishery Bulletin, Vol. 76, No. 2, p 323-334, April 1978. 2 fig, 7 tab, 32 ref. ONR N00014-66-C-0240, N00014-24-C-0262, NR083-004, NSF DES 74-02783A1.

Descriptors: *Zooplankton, *Cold core rings, *Sargasso Sea, *Distribution, *Ocean currents, *Biomass, Gulf Stream, Atlantic Ocean, Oceans, Slope water, Phytoplankton, Algae, Primary productivity, Deep water, Organic matter, Diel migration, Biorhythms, Hydrology, Hydrography, Food chains, Standing crops, Seas.

Zooplankton of the northern Sargasso Sea (Atlantic Ocean) are more heterogeneous than previously recognized, due to incursion of Gulf Stream cold core rings. Such rings are mesoscale hydrological features 150-300 km in diameter and up to several thousand meters deep, formed when southerly directed meanders of the Gulf Stream are strong enough to separate from the stream and move south, the remnant enclosing a core of cold and relatively fresh slope water. At a given time there are likely to be 10-15 rings which may cover 6-13% of the 3.3 million-sq km northern Sargasso Sea and which are more productive than the surrounding sea. They have a zooplankton biomass intermediate between the Sargasso Sea and the slope water. Cold corerings may augment primary productivity 3-7%, and zooplankton standing crop 8-16%. An unusually large number of the biomass in rings is found at depths greater than 200 m, in comparison with the surrounding sea or the parent slope water. This distribution may be related to hydrographic and biological changes associated with ring decay. Rings may provide a disproportionately large fraction of the total supply of organic matter to the northern Sargasso deep sea because of their higher productivity, differences in vertical biomass structure, and possibly lower food chain efficiency than that of the Sargasso Sea. Most of the data was collected on cruises in August and November 1975. Ring-D was sampled, formed in February 1975. (Lynch-Wisconsin)
W79-04769

CONTINUOUS STANDARD WATER DELIVERY SYSTEM FOR BIOASSAYS WITH AQUATIC ORGANISMS,
Rijksinstituut voor Drinkwater-voorziening, Leidschendam (Netherlands).
W. Slooff, E. Rab, and T. B. Spierenburg.
The Progressive Fish-Culturist, Vol. 40, No. 3, p 112-114, July 1978. 2 fig, 4 ref.

Descriptors: *Bioassay, *Methodology, *Testing procedures, *Water delivery, *Water purification, Laboratory tests, Water pollution effects, Toxicity, Poisons, Pollutants, Automation, Salts, Filtration, Continuous flow.

A reliable automatic system for purifying and reconstituting bioassay test water is presented. Effects of pollutants on aquatic organisms can only be determined in test water of acceptable quality. Surface water does not meet bioassay requirements because of quality variability and because substances may be present that can induce toxic effects of test organisms or influence the test effect of a toxicant under investigation. Ordinary municipal water often contain chlorine or chloramine which are highly toxic to aquatic organisms. Dissolved solids in groundwater can also disturb bioassays. The purification system described here consists of: (1) dechlorination of tap water by carbon filtration; (2) temperature control using a boiler, refrigeration, and a temperature regulator; and (3) water purification with a 30-micrometer filter, DKV-3.5 automatic softeners, two hollow-fiber reverse-osmosis units with front 10-micrometer filters, and a mixed-bed ion exchange. The system delivers highly purified water at up to 900 l/hr. Certain amounts of several chemicals must be added to the purified water prior to bioassay; apparatus for this purpose is described which utilizes valves and tanks. This system also permits use of toxicant injectors to create constant toxicant levels. (Lynch-Wisconsin)
W79-04770

HETEROTROPHIC UTILIZATION OF ORGANIC CARBON IN AQUATIC ENVIRONMENTS,
Tennessee Univ., Memphis. Dept. of Biochemistry.
G. S. Sayler, and C. M. Gilmour.
Journal of Environmental Quality, Vol. 7, No. 3, p 385-391, 1978. 12 fig, 1 tab, 22 ref.

Descriptors: *Dissolved organic carbon, *Carbon, *Bacteria, *Heterotrophic organisms, *Eutrophication, *Reservoirs, *Growth rates, Idaho, Spring Valley Reservoir(ID), Sworshak Reservoir(ID), Trophic level, Bioassay, Water pollution effects, Respiration, Glucose, Metabolism, Cycling nutrients, Vitamins, Nitrogen, Phosphorus, Nutrients, Sewage.

Samples of waste water and water from two eutrophic Idaho reservoirs showed that dissolved organic carbon (DOC) concentration regulates rate and net response of heterotrophic bacterial growth and activity in aquatic environments, assuming no deficiencies in other essential nutrients. Organic carbon concentrations of sewage samples and water samples from Dworshak and Spring Valley Reservoirs were determined by a modified persulfate wet combustion method. DOC levels reflect net trophic conditions unique to individual sampling locations, and are therefore useful in eutrophication and pollution assays. A direct linear relationship existed between heterotrophic activity and the concentration of available DOC. Significant responses to heterogenous carbon substrates were detected at concentrations common to pristine, low DOC water. Oxygen uptake was more sensitive for measuring heterotrophic bacterial response to simulated DOC enrichment than carbon dioxide evolution, substrate utilization, or biomass production. Results indicated growth factors or vitamin limitations occurred in some aquatic samples. Electrolytic respirometry was used to assess heterotrophic respiration responses to DOC in natural and enriched water samples. Concentration ranges of dissolved organic carbon furnished by sewage and glucose supplemented with micronutrients were incorporated into natural water samples. (Lynch-Wisconsin)
W79-04771

SEASONAL GROWTH AND SUCCESSION OF TROPICAL AND INTRODUCED PHYTOPLANKTON CULTURED IN DEEP SEA WATER,
Marine Biology Station, Arraial do Cabo (Brazil).
Y. Y. Braga, and L. D. Druehl.
Aquaculture, Vol. 14, No. 1, p 1-12, May 1978. 4 fig, 5 tab, 14 ref.

Descriptors: *Aquiculture, *Dominant organisms, *Phytoplankton, *Deep water, *Nutrients, *Diatoms, Seasonal, Pennate diatoms, Species composition, Algae, Oceans, Atlantic Ocean, Brazil, Arraial do Cabo(Brazil), Floral lists, Carbon, Primary productivity, Urea, Superphosphate, Phosphates, Platymonas, Dunaliella tertiolecta, Skeletonema costatum, Phaeodactylum tricornutum, Chrysophyta, Abundance, Plant growth, Succession, Tropical regions.

As part of the Cabo Frio Project, an aquiculture system being developed on the Atlantic Coast in the vicinity of Arraial do Cabo, east of Rio de Janeiro, Brazil, experiments were conducted 1975-76 to determine seasonal phytoplankton dominance in relatively nutrient-rich seawater pumped from a depth of 42 meters and held in concrete tanks. The seawater is used to support growth of shrimp and oysters, which require phytoplankton, and fish, which do not. Indigenous phytoplankton will serve either as a nutrient source, as a competitor to introduced phytoplankton, or as a fouling agent. Culturing conditions: (1) indigenous phytoplankton in unaltered deep-sea water, (2) indigenous phytoplankton in deep-sea water enriched with urea and superphosphate, and (3) deep-sea water inoculated with either Platymonas sp., Dunaliella tertiolecta, Skeletonema costatum, or Phaeodactylum tricornutum. Productivity estimates were assessed by particulate carbon. Results: (1) pennate diatoms dominated indigenous populations throughout the year, though species composition changed; (2) introduced species generally grew well, but all gave way to the natural populations after an early bloom, except Phaeodactylum, which inhibited development of, or eliminated, natural diatom populations; (3) maximum cell concentrations only once fell below 100 million cells/l; and (4) greatest growth occurred in nutrient-enriched cultures (mean 710 million cells/l), compared with a mean of 280 million cells/l in unaltered seawater. (Lynch-Wisconsin)
W79-04772

THE PRODUCTIVITY OF MESOCYCLOPS LEUCKARTI (CLAUS) IN LAKE KINNERET (ISRAEL),
Kinneret Limnology Lab., Tiberias (Israel).
M. Gophen.
Hydrobiologia, Vol. 60, No. 1, p 17-22. July 1978. 2 fig, 4 tab, 26 ref.

Descriptors: *Lake Kinneret(Israel), *Productivity, *Mesocyclops leuckarti, *Life history studies, *Growth stages, *Growth rates, Biomass, Respiration, Israel, Lakes, Zooplankton, Instars, Copepodids, Nauplii, Water temperature, Metabolism, Food habits, Feeding rates.

Growth dynamics of the copepod Mesocyclops leuckarti were studied in Lake Kinneret, Israel, one of the few lakes in which M. leuckarti is dominant. The organism is widely distributed in lakes of varying salinity, temperature, and associated organisms, reflecting its high adaptability. In Lake Kinneret specific growth rate of young male instars varied 0.03-0.26 micrograms wet wt/microgram wet wt/day at 15 and 22 C, and that of young female instars 0.03-0.17 micrograms, while at IV-V copepodid stages females had the higher rates. During 1969-75 productivity averaged 44 (+ or -23) g wet wt/sq m/mo (five g dry wt), and monthly productivity/biomass (P/B) ratios averaged 3.1. P/B ratios were highly correlated (r squared=0.98) with temperature changes. Metabolic parameters and P/B ratios were similar to other water bodies, demonstrating M. leuckarti's adaptability. Productivity was calculated on the basis of average number of individuals (nauplii, copepodids, adult females) collected in routine samples, average epilimnetic temperatures, experimental growth rates at 15, 22, and 27 C as averages for male and female nauplii and copepodids, and

potential egg-production of adult females as their productivity measure (adult male productivity was taken as zero). Respiration and food intake were the metabolic parameters. (Lynch-Wisconsin)
W79-04773

PHOSPHORUS AND NITRATE RUN-OFF IN HILL PASTURE AND FOREST CATCHMENTS, TAITA, NEW ZEALAND,
Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Soil Bureau.
R. H. S. McColl, F. White, and A. R. Gibson.
New Zealand Journal of Marine and Freshwater Research, Vol. 11, No. 4, p 729-744, December 1977. 2 fig, 4 tab, 24 ref.

Descriptors: *Phosphorus, *Nitrates, *Watersheds(Basins), *Forest watersheds, *Pastures, *Surface runoff, *Taita experimental basin(New Zealand), Runoff, Agricultural runoff, Streamflow, Floods, New Zealand, Nitrogen, Nutrients, Water pollution sources, Hutt Valley(New Zealand), Streams, Regression analysis, Ammonium.

Nutrient losses in runoff from four watersheds of the Taita Experimental Basin on the eastern side of New Zealand's Hutt Valley in 1971-1973 were highly dependent on floods and were therefore very spasmodic. This pattern must influence plant growth in receiving waters, a factor generally overlooked. Up to 83% of nitrate losses and an estimated 47-70% of phosphorus losses occurred during two large floods. In a hill pasture catchment 48% of nitrate and 31% of phosphorus were apparently lost during a single flood. Less than 20% of phosphorus losses and as little as 1% of nitrate losses occurred during low flows. At low flows, the hill pasture (fertilized with lime at 630 kg/ha/yr and superphosphate at 380 kg/ha/yr) tended to lose more nutrients than the forested land, but differences were small. During large floods, the hill pasture lost about three times as much reactive phosphate and 2-5 times as much total phosphorus as the forested land, and 130-190 times as much nitrate as two of the forest watersheds. Losses of total phosphorus via watershed streams were estimated at 293 h/ha/yr for the hill pasture, 124-201 g for two native watersheds, and 71 g for a non-native conifer watershed, and nitrate-nitrogen losses at 1356 g, 11.5-1436 g, and 44 g, respectively. (Lynch-Wisconsin)
W79-04774

A COMPARISON OF METHODS FOR MEASURING PRIMARY PRODUCTIVITY AND COMMUNITY RESPIRATION IN STREAMS,
Academy of Natural Sciences of Philadelphia, Avondale, PA. Stroud Water Research Center.
T. L. Bott, J. T. Brock, C. E. Cushing, S. V. Gregory, and D. King.
Hydrobiologia, Vol. 60, No. 1, p 3-12, 1978. 1 fig, 5 tab, 29 ref. BMS75-07333.

Descriptors: *Methodology, *Primary productivity, *Metabolism, *Respiration, *White Clay Creek(PA), *Streams, Measurement, Analytical techniques, Testing procedures, On-site tests, Chambers, Algae, Benthic flora, Diatoms, Chlorophyll, Community respiration, Carbon dioxide, Oxygen exchange, Gas exchange, Standing crops, Diffusion, Alkalinity.

Simultaneous measurement of community metabolism (primarily benthic diatoms) in White Clay Creek, Chester County, Pennsylvania, using five assessment methods yielded variable results. Chamber techniques gave estimates of primary productivity per unit of photosynthetic material which differed two- to four-fold, but which were within an expected range when normalized for chlorophyll-a. Open-stream carbon and oxygen metabolism estimates were complicated in this habitat by high diffusion rates, and metabolic balances determined from these methods were consistently lower than with the chamber methods. Techniques incorporating a recirculating chamber offer the most attractive method for measuring metabolism in high-gradient streams. Methods tested: (1) open-system oxygen method, (2) open-system carbon dioxide method, (3) oxygen change in chambers embedded in the stream bottom, (4) oxygen change in chambers on the stream bank, and (5) carbon dioxide change in chambers in-situ with recirculating water. Balances of photosynthesis and respiration from the chamber methods were similar between methods, indicating that autotrophic or heterotrophic processes could dominate the system. Though diffusion rates of carbon dioxide are usually lower than diffusion rates of oxygen, degree of saturation must be considered when applying the carbon dioxide method; low-order streams may be oversaturated with carbon dioxide. When chamber methods are used, considerable replication is required to compensate for the heterogeneity of lotic systems. (Lynch-Wisconsin)
W79-04775

NITROGEN-FIXATION IN THE LITTORAL BENTHOS OF AN OLIGOTROPHIC LAKE,
Cornell Univ., Ithaca, NY. Section of Ecology and Systematics.
R. E. Moeller, and J. P. Roskoski.
Hydrobiologia, Vol. 60, No. 1, July 1978, p 13-16. 1 fig, 1 tab, 18 ref.

Descriptors: *Nitrogen fixation, *Cyanophyta, *Mirror Lake(NH), *Oligotrophy, *Benthic flora, *Epiphytes, *Periphyton, Nitrogen cycle, Nutrients, Lakes, Acetylene reduction, Nitrogen, New Hampshire, Algae, Assay, Littoral, Macrophytes, Benthos, Lobelia dortmanna, Isoetes tuckermani, Utricularia purpurea, Gloetrichia, Anabaena, Nostoc, Substrates, Sands, Mud.

Acetylene-reduction assays September-October 1975 indicated that blue-green algae on macrophytes and unvegetated benthic substrates in the littoral of oligotrophic Mirror Lake in New Hampshire's White Mountains region are a significant source of nitrogen in the lake. However, fixation rates were too low to contribute much toward the annual nitrogen requirements of the macrophytes. The cyanophytes fixed nitrogen at 0.1-1.0 micrograms N/g macrophyte dry wt/hr, and 0.5-400 micrograms N/sq m of littoral lake bottom/hr. Divers collected whole rosettes of Lobelia dortmanna and Isoetes tuckermani, six-node apical portions of Utricularia purpurea, and samples of soft substrates. Plants were rinsed and assayed for nitrogenase activity by acetylene-reduction, and nitrogen fixation was calculated according to the ratio of three moles ethylene produced per mole of nitrogen fixed. Colonies of the heterocyst-bearing cyanophyte Gloeotrichia were always present on leaves of Isoetes and Lobelia, which typically support few epiphytes; high variability of nitrogen fixation between Lobelia colonies appeared to correlate with visual estimates of Gloeotrichia density. Of total nitrogen-fixing activity from Lobelia and Utricularia samples, 61-88% was removed by wiping the leaves. Substrate assay results varied greatly among sites, with highest rates associated with massive occurrence of heterocyst-bearing cyanophytes, notably Anabaena and Nostoc. (Lynch-Wisconsin)
W79-04776

THE ECOLOGICAL HISTORY OF A MEDIAEVAL MAN-MADE LAKE, HICKLING BROAD, NORFOLK, UNITED KINGDOM,
University of East Anglia, Norwich (England). School of Environmental Sciences.
B. Moss.
Hydrobiologia, Vol. 60, No. 1, p 23-32, 1978. 6 fig, 34 ref.

Descriptors: *Artificial lakes, *Hickling Broad(United Kingdom), *History, *Paleolimnology, *Paleoecology, *Sedimentation rates, *Eutrophication, United Kingdom, Norfolk Broads(United Kingdom), Lakes, Peat, Sediments, Cores, Agriculture, Guano, Epiphytes, Diatoms, Phytoplankton, Algae, Macrophytes, Turbidity, Black-headed gulls, Larus ridibundus, Birds, Alkalinity, Saline lakes, Radioactive dating, Lead, Fishkill.

The ecological history of Hickling Broad, a lake created in the 14th or 15th century by flooding of alkaline peat diggings in the Norfolk area, United Kingdom, was traced through lead-210 dating of a sediment core, historical information, and recent limnological studies, from an early static period to its current hypereutrophic state. Three phases are distinguished: (1) About 1400 to 1930s--little major change, very low sedimentation rates (0.028 cm/yr), sparse diatom remains (none planktonic), low planktonic populations, and dominance of macrophytes by Chara spp, with some Najas marina; the basin contained a greater extent of undrained marshes and fens which reduced nutrient load to the lake. (2) 1930s to mid or late 1960s--increased basin drainage and use of land for agriculture with considerable fertilization led to much higher organic and inorganic sedimentation rates (0.25 cm/yr), abundant growth of submerged macrophytes, and steady increase of epiphytic diatoms. (3) Mid 1960s to present--hypereutrophication, attributable mainly to droppings from a greatly increased roost of migratory black-headed gulls (Larus ridibundus) on the lake in autumn and winter, reaching about 250,000 in 1976; the sedimentation rate rose to 0.5 cm/yr, epiphytic diatoms increased markedly, and in the early 1970s the previously clear waters became turbid with phytoplankton and the once-luxuriant macrophytes became sparse, now dominated by Potamogeton pectinatus. Hickling Broad is a National Nature Preserve. (Lynch-Wisconsin)
W79-04777

MORPHOLOGICAL VARIATION AND LIFE HISTORY IN CYLINDRICAL FORMS OF SCYTOSIPHON LOMENTARIA (SCYTOSIPHONACEAE: PHAEOPHYTA) FROM SOUTHERN AUSTRALIA,
Monash Univ., Clayton (Australia). Dept. of Botany.
M. N. Clayton.
Marine Biology, Vol. 47, No. 4, p 349-357, 1978. 7 fig, 3 tab, 21 ref.

Descriptors: *Phaeophyta, *Scytosiphon lomentaria, *Life history studies, *Plant morphology, *Reproduction, *Thalli, *Pleomorphism, Growth stages, Plant growth, Algae, Australia, Scytosiphonaceae, Cylindrical form, Sporangia, Microthalli, Sexual reproduction, Asexual reproduction, Zoospores, Seasonal, Habitats, Plurilocular sporangia, Unilocular sporangia.

Investigation of the south Australian polymorphic phaeophyte alga, Scytosiphon lomentaria, and of its cylindrical form showed that morphological variation among natural populations is of a continuous nature, and the species cannot on the basis of morphology be readily segregated into distinct subspecific taxa. S. lomentaria includes within its life history at least three broadly distinct kinds of thallus: (1) cylindrical, (2) complanate, and (3) a prostrate, encrusting form. Considerable morphological plasticity is shown by each form, at least partly due to environmental factors. The cylindrical form was sampled at different times of the year in a variety of habitats in the temperate southeastern region of Australia to assess morphological diversity, and for studies of reproduction and life history wild plants were collected and cultured. Zoospores derived from plurilocular sporangia developed asexually into cylindrical thalli under long and short days at 16 C. The progeny of some cylindrical thalli included microthalli bearing plurilocular or unilocular sporangia; cylindrical forms were obtained in culture from wild microthalli of two kinds--bearing either plurilocular or unilocular sporangia. The microthalli differ morphologically from the ralfsioid stages commonly known to be plethysmothalli and sporophytes of S. lomentaria, but closely resemble microthalli derived from cultures of wild S. lomentaria. (Lynch-Wisconsin)
W79-04778

UV-INDUCED DEVELOPMENTAL ABNORMALITIES IN THE FILAMENTOUS BLUE-GREEN ALGA NOSTOC LINCKIA,
Banaras Hindu Univ. (India). Dept. of Botany.
D. N. Tiwari.
Biochemie und Physiologie der Pflanzen, Vol. 172, No. 5, p 537-540, 1978. 2 fig, 11 ref.

Descriptors: *Nostoc linckia, *Mutation, *Plant growth, *Ultraviolet radiation, *Cytological studies, *Spores, Cell division, Cyanophyta, Reproduction, Filamentous algae, Germinating spores, Resting spores, Plant physiology, Ammonium, Nitrogen, Germlings, Plant morphology, Cell cycle, Life history studies, Clones.

The formation and fate of a mutant clone of the unbranched filamentous cyanophyte alga Nostoc linckia, taken from a colony of N. linckia irradiated with ultraviolet radiation, was traced in detail. Many of the abnormally large, spheroidal cells formed spores which germinated upon return to growth-conducive conditions, generating different types of germlings from the abnormals, and which in some cases proved lethal. the possibility of a transient polyenergidic and/or heterozygous state of these giant cells is discussed. In the original experiments, germinating spores of N. linckia showed higher resistance to UV irradiation than resting spores, with maximal resistance attained more rapidly in the presence of ammonium nitrogen. With further growth, UV-irradiated germinating spores formed colonies of the giant cells under nonphotoreactivating conditions. The clone selected (M-5) showed nearly an 80-85% population of giant cells. Up to 63% of germinating spores showed higher resistance to UV-irradiation on ammonium agar, and 19% on minimal nitrogen agar with a 12-min dose, which was lethal to resting spores. At high doses there was a preponderance of colonies with giant cells 20-25 times as voluminous as normal cells, presumably resulting from a block or delay in septum formation. Concomitant differentiation of 2-5 vegetative cells into heterocysts was also a common feature. Clones raised from abnormal colonies usually showed gradual disappearance of the giant cells, except for M-5 in which the giant cells persisted through several serial transfers. (Lynch-Wisconsin)
W79-04779

SYNCHRONIZED CULTURE OF THE HALOTOLERANT UNICELLULAR GREEN ALGA DUNALIELLA PARVA,

Wuerzburg Univ. (Germany, F.R.). Botanishches Inst. II.
M. Bruggemann, C. Weiger, and H. Gimmler.

Biochemie und Physiologie der Pflanzen, Vol. 172, No. 5, p 487-506, 1978. 10 fig, 3 tab, 56 ref.

Descriptors: *Dunaliella parva, *Photosynthesis, *Synchronization, *Photoperiodism, *Plant physiology, *Osmoregulation, *Cytological studies, *D. viridis, Halotolerance, Salinity, Plant growth, Chlorophyll, Proteins, Energy conversion, Cultures, Chlorophyta, Algae, Unicellular algae, Testing procedures, Methodology, Laboratory tests, Metabolism, Respiration, Biochemistry, Growth rates, Cell cycle, Beneficial use, Biorhythms, Electron transport system.

The cell cycle of the halotolerant unicellular chlorophyte alga Dunaliella parva (also known as D. viridis) was successfully synchronized with a light-dark regime of 14:10 hrs at 30C, pH 7.6, and a concentration of one million cells/ml in an inorganic medium. Cytological and physiological growth characteristics of the cell cycle of D. parva were investigated, with emphasis on photosynthesis and osmoregulation. D. parva, with high growth rate, is easy to culture, lacks a rigid cell wall, is a source of carotinoids, protein, and glycerol, and is a good converter of solar energy into usable chemical energy. Synchronization of the cell cycle significantly improves data reproductivity. Protein/ml algal suspension increased linearly during the light period, and at a reduced rate during the dark period indicating carbohydrate conversion into protein. Photosynthetic carbon dioxide assimilation activity (based on chlorophyll content) was highest in the sixth hour of the light period. Maximal CO2-fixation rates were 2-3 times higher than with nonsynchronous D. parva. Total chlorophyll and carotinoids increased exponentially during the light period. Changes in photosynthetic CO2 assimilation during the cell cycle are assumed caused by changes of the photosynthetic electron transport system. Both photosystems may develop parallel to one another in all synchronized algae, but the use cells make of system I may differ depending on external factors which influence the balance between the photosynthetic electron transport systems. (Lynch-Wisconsin)
W79-04780

FEEDING OF MARINE PLANKTONIC COPEPODS IN MIXED PHYTOPLANKTON,

Skidaway Inst. of Oceanography, Savannah, GA.
G. A. Paffenhofer, and S. C. Knowles.

Marine Biology, Vol. 48, No. 2, p 143-152, 1978. 4 fig, 7 tab, 21 ref. NSF OCE76-01142.

Descriptors: *Copepods, *Zooplankton, *Grazing, *Phytoplankton, *Eucalanus pileatus, *Temora stylifera, *Temora turbinata, Particle size, Food habits, Feeding rates, Marine algae, Algae, Skeletonema costatum, Leptocylindrus danicus, Rhizosolenia alata f. indica, Carbon, Nauplii, Copepodids, Growth stages, Adults, Diatoms, Chrysophyta, Southeast U.S., Continental shelf, Oceans, Atlantic Ocean, Marine biology, Food chains.

Food-size preferences of nauplii, copepodids, and adults of the marine calanoid copepods Eucalanus pileatus, Temora stylifera, and T. turbinata, common to the southeastern U.S. continental shelf, were studied, using three dominant diatom species as food. Diatoms were: (1) Skeletonema costatum (ave cell diam 4.5 micrometers, cell vol 60 cu micrometers); (2) Leptocylindrus danicus (diam 15 micrometers, vol 8000 cu micrometers); and (3) Rhizosolenia alata f. indica (diam 23 and 68 micrometers, vol 100,000 and 1.1 million cu micrometers). E. pileatus nauplii, copepodids, and adult females ingested relatively equal percentages of the three algal species in terms of carbon. Temora juveniles younger than copepodid II ingested mainly the smaller S. costatum; at older stages feeding on the larger L. danicus and R. alata f. indica increased with increasing body wt, while ingestion of S. costatum remained constant. Feeding on high concentrations of large particles reduced grazing pressure on small particles, thus favoring zooplankton with small food-size requirements. Ability of the Temora nauplii to ingest L. danicus may be limited by mandible strength to break the cells, since they are known to feed on 19 x 23-micrometer Periodinium trochoideum. Feeding on E. pileatus on 68-micrometer R. alata f. indica did not start until nauplii IV-V, when body length reached 420-520 micrometers. Potential food range for Temora nauplii is 4-20 micrometers, while for E. pileatus it is 4.5 to over 100 micrometers. (Lynch-Wisconsin)
W79-04781

RESEARCH ON ASCORBIC ACID PHYSIOLOGY IN RED ALGAE. IV. ON THE SEASONAL VARIATION OF AA/DHA RATIO IN PTEROCLADIA CAPILLACEA (GMEL.) BORN. ET THUR. (RHODOPHYTA, GELIDIALES).

Bari Univ. (Italy). Inst. of Botany.
R. Liso, G. Calabrese, and M. Chieppa.

Phycologia, Vol. 17, No. 2, p 143-147, June 1978. 2 fig, 1 tab, 17 ref.

Descriptors: *Rhodophyta, *Pterocladia capillacea, *Ascorbic acid, *Dehydroascorbic acid, *Seasonal, *Plant growth, *Plant physiology, Algae, Growth rates, Vitamins, Oxidation-reduction potential, Grotta Regina(Italy), Italy, Seas, Adriatic Sea, Gelidiales, Fronds, Thalli, Metabolism.

In studies of the red alga Pterocladia capillacea major variations of the ascorbic acid/dehydroascorbic acid (AA/DHA) ratio were found in apical portions of erect fronds; the ratio reached about 16 in December, decreased in spring to about six and remained generally low in summer. AA and DHA curves were inversely related, with much greater variation in AA relative to DHA, and with much higher levels of AA than DHA. Statistical analysis showed the cyclic trend to be highly significant. In the basal portion of the thallus the AA/DHA ratio was very low (about two) throughout the year. P. capillacea was collected in Grotta Regina on the Adriatic coast at Bari, Italy monthly October 1974 to September 1976. The AA and DHA system is important in regulating cell metabolism due to the molecule's ability to undergo oxidation-reduction processes, and the AA/DHA ratio is closely and positively related to red algal growth, as it is in higher plants. Elongation of the main axis and later branches of the erect frond of P. capillacea is linear throughout the year, while considerable seasonal variation is found in diameter. The frond's apical portions are thinner (< one mm) in spring and summer, then flatten out and increase in breadth, reaching a maximum thickness of 2-3 mm in winter due to continued division of the cortical cells (the apical cells of the lateral branches of limited growth). (Lynch-Wisconsin)
W79-04782

OCCURRENCE OF ENDOPHYTIC BACTERIA IN SIPHONOUS ALGAE,

Padua Univ. (Italy). Ist. di Botanica e Fisiologia Vegetale.
P. M. Colombo.

Phycologia, Vol. 17, No. 2, p 148-151, June 1978. 9 fig, 5 ref.

Descriptors: *Bacteria, *Endophytes, *Siphonous algae, *Halimeda tuna, *Udotea petiolata, Seas, Italy, Siphons, Algae, Symbiosis, Electron microscopy, Tyrrhenian Sea, Adriatic Sea, Thalli, Vacuoles, Chloroplasts, Depth.

A brief account is given of the occurrence of endophytic bacteria in the thalli of the siphonous algae Udotea petiolata and Halimeda tuna, between the siphons and within coenocytic filaments. The bacteria were usually located in the vacuole, and preferentially very near the chloroplasts. The bacteria cause no alteration or damage to the structure of the algae, and were observed to divide, suggesting a possible physiological equilibrium between the organisms. The location of the bacteria near the chloroplasts and generally in the younger zones of the thallus might indicate a link with algal photosynthesis and their probable oxygen-dependence, but no firm evidence of symbiosis can be presented as yet. Udotea was collected at sea depths of 0.5, 2.0, 4.0, and 6.0 m at Capo Carbonara (Sardinia, Italy), and Halimeda at sea depths of 0.5 and 6.0 m at Porto Cesareo (Lecce, Italy). Both were fixed under water and studied with electron microscopy. The endophytic bacteria, quite similar in the two plant species, were characterized by a thick cell envelope and by cytoplasm with a central nucleoid in which DNA-like microfibrils were often visible, and were 0.3-0.5 micrometers in diameter and 1.5-2.0 micrometers long. Bacteria with an external fibrillar sheath were observed on a Udotea plant. The number of endophytes seems to decline with increasing depth. (Lynch-Wisconsin)
W79-04783

THE SPRING PHYTOPLANKTON BLOOM IN LINDASPOLLENE, A LANDLOCKED NORWEGIAN FJORD. II. BIOMASS AND ACTIVITY OF NET-AND NANOPLANKTON,

Bergen Univ. (Norway). Inst. of Marine Biology.
H. R. Skjoldal, and C. Lannergren.

Marine Biology, Vol. 47, No. 4, p 313-323, 1978. 6 fig, 4 tab, 49 ref.

Descriptors: *Lindaspollene(Norway), *Fjords, *Net plankton, *Nannoplankton, *Biomass, *Eutrophication, *Algae, Zooplankton, Copepods, Norway, Adenosine triphosphate, Chlorophyll, Phaeophytin, Carbon radioisotopes, Respiration, Carbon, Nutrients, Silicates, Benthos, Skeletonema costatum, Diatoms, Chrysophyta, Depth, Oxygen.

Relative contributions of net (less than 30 micrometers) and nannoplankton to total biomass, carbon assimilation, and oxygen utilization were determined for Lindaspollene, a landlocked fjord on Norway's Atlantic coast during the spring phytoplankton bloom February-April 1975. Biomass was measured in terms of chlorophyll-a and adenosine triphosphate (ATP), and oxygen utilization as electron transport system (ETS) activity. Net plankton averaged 48% of total chlorophyll-a and 56% of the ATP, but contributed only 7% to total carbon assimilation and 11% to ETS activity. Assimilation values (mg C assimilated/mg chl-a/hr) were 0-1.2 for net plankton and 1.5-13.2 for nannoplankton.

High concentrations of ATP (but not chlorophyll-a) were found in the nannoplankton fraction at the oxygen/hydrogen sulfide interface. Net planktonic algae grew actively only in the first phase of the bloom, while nannoplankton dominated later, apparently due to low nutrient concentrations. Skeletonema costatum dominated the biomass during the bloom. Number of cells in the chains decreased during the bloom, possible reflecting lowered silicate content. Only nannoplankton appeared to be grazed by zooplankton (dominated by copepods), while net plankton sank to the bottom. The phaeophytin/chlorophyll-a ratio was less than 0.6 during the bloom, increasing after the bloom especially at 30-50 m probably because of debris sinking from the bloom. (Lynch-Wisconsin)
W79-04784

NEW RECORDS OF MARINE ALGAE FROM CHILE AND THEIR EFFECT ON PHYTOGEOGRAPHY,
Universidad Catolica de Chile, Santiago. Lab. de Zoologia.
B. Santelices, and I. A. Abbott.
Phycologia, Vol. 17, No. 2, p 213-222, June 1978. 2 fig, 2 tab, 74 ref.

Descriptors: *Phytogeography, *Chile, *Marine algae, *Chlorophyta, *Phaeophyta, *Rhodophyta, *Distribution, *Classification, Algae, South America, Temperate, Tropical regions, Cold regions, Geographical regions, Peru, Classification, Floral lists, Coasts, Oceans, Pacific Ocean.

Of 40 species of marine algae newly reported from central and northern Chile, 17 are new to Pacific South America, and the rest are range extensions from Peru and within Chile. Twenty-one Rhodophyta, 10 Chlorophyta, and nine Phaeophyta are included. Twenty-one taxa are primarily temperature plants and represent a group of biopolar species, seven are tropical, and six are subantarctic. The mix of species reflects the long Chilean coastline, the great topographical variation of which affects ecology and distribution. About half the species were collected near Valparaiso. Rhodophyta include Porphyropsis coccinea, Acrochaetium amphiroae, A. polysporum, Asparagopsis armata, Gelidium congestum, Pterocladia caloglossoides, Schimmelmannia plumosa, Trematocarpus dichotomus, Montemaria horridula, Rhodymenia hancockii, Dendrymenia skottsbergii, Ballia callitrichia, Ceramium stichidiosum, Tiffaniella snyderiae, Anisocladella pacifica, Branchioglossum brattstroemii, Polysiphonia scopulorum var. villu, Herposiphonia ceratoclada, H. sulivaniae, Bostrychia rivularis, and B. scorpioides; Chlorophyta include Chaetomorpha firmə, C. melagonium, Ulva costata, U. taeniata, Rama novae-zelandiae, Clodophoropsis herpestica, Bryopsis peruviana, B. rhizophora, Derbesia marina, and Codium dimorphum; and Phaeophyta include Giffordia granulosa, Spongoneam tomentosum, Ralfsia pacifica, Halopteris hordacea, Hapalospongidion gelatinosum, Haploglοia andersonii, Colpomenia tuberculata, Endarachne binghamiae, and Adenocystis utricularis. (Lynch-Wisconsin)
W79-04785

THE GROWTH AND DEATH OF THE MACROCYSTIS SPOROPHYTE (PHAEOPHYCEAE, LAMINARIALES),
New Brunswick Univ., St. John. Div. of Sciences.
C. S. Lobban.
Phycologia, Vol. 17, No. 2, p 196-212, June 1978. 14 fig, 2 tab, 82 ref.

Descriptors: *Plant physiology, *Plant morphology, *Phaeophyta, *Plant growth, *Macrocystis pyrifera, *Macrocystis angustifolia, *Macrocystis integrifolia, *Growth stages, Growth rates, Reviews, Metagenesis, Sporophytes, Nutation, Holdfasts, Sessile algae, Algae, Haptera, Death, Life history studies, Life cycles, Senescence, Fronds, Life span, Canopies, Sporophylls, Laminariales.

Previous research on the phaeophyte algal genus Macrocystis is reviewed to develop a composite description of the plant's development, emphasizing growth and death of the Macrocystis sporophyte. Anatomical and physiological development is examined from the undivided lamina stage until death. Of three species currently recognized, most literature refers to economically important M. pyrifera, no published physiological data exists on M. angustifolia, and the author's research has centered on M. integrifolia. Spiral and alternate blade arrangements are both the results of spontaneous movement during growth; blades are initiated in one plane. Sporphylls can be viewed as modified fronds. Haptera are negatively phototropic, and thigmotropism seems to stop their growth. Growth curves are used to define juvenile, mature, and senile phases. Growth of fronds, and perhaps of sporophylls, is indeterminate, but growth of laminae is determinate. Plants live 4-8 years, fronds normally about six months. Canopy structure and blade arrangement can be compared to forest canopies. Macrocystis does not readily recruit, and M. integrifolia in particular relies more on vegetative propagation than on sexual reproduction to maintain itself. Plant growth is both environmentally and internally regulated. Known algal hormones are briefly reviewed, and possible hormore action in Macrocystis is discussed. Fertility may be controlled by substances left by the apical meristem in laminae which are to remain sterile. (Lynch-Wisconsin)
W79-04786

PATHWAY AND PRODUCTS OF CO2-FIXATION BY GREEN PROKARYOTIC ALGAE IN THE CLOACAL CAVITY OF DIPLOSOMA VIRENS,
Nagoya Univ. (Japan). Research Inst. for Biochemical Regulation.
T. Akazava, E. H. Newcomb, and C. B. Osmond.
Marine Biology, Vol. 47, No. 4, p 325-330, 1978. 4 fig, 1 tab, 22 ref. NSF-GB 36173, GA 34948, GD 34462.

Descriptors: *Diplosoma virens, *Chlorophyta, *Photosynthesis, *Prokaryotic algae, *Carbon dioxide, Ascidiacea, Tunicata, Algae, Cloacal cavity, Chloropyll, Enzymes, Photosynthetic products, Metabolism, Australia, Great Barrier Reef(Australia), Lissoclinum punctatum, Polymers, Carbon radioisotopes, Pathways, Pigments, Biochemistry, Oligosaccharides, Sucrose, Sugars.

Experiments with the bright-green, unicellular, prokaryotic, chlorophyte algae living in the cloacal cavity of the didemnid ascidian (sea squirt) Diplosoma virens, collected in 1973 and 1976 from two sites on Australia's Great Barrier Reef, show that: (1) photosynthetic carbon dioxide assimilation by these unusual algae evidently proceeds via the initial carboxylation of ribulose-1,5-biphosphate; (2) the principle end-product of carbon fixation is a water-soluble oligosaccharide (an alpha-1,4-glucan); and (3) photosynthetic products are not rapidly incorporated into the structural material of the animal host. Light-dependent carbon-14 carbon dioxide fixation ranged 3-27 micromoles/mg chlorophyll/hr. A maximum of 7% of the carbon-14 fixed was found in insoluble materials of the algae or its host after one hr of carbon-14 carbon dioxide fixation. Whether the alpha-1,4-glucan is a product of algal or animal metabolism remains to be determined. The algae probably fix carbon dioxide by the conventional C3 carbon-reduction pathway, but differ from higher plants and other chlorophytes in which sucrose is the major photosynthetic end-product. These algae, also found in ascidians from Bja California, Mexico, have attracted attention because, although prokaryotic, contain the complement of chlorophyll pigments thought to exist only in eukaryotic cells. Neither phycobilosomes nor bilin pigments have been detected. (Lynch-Wisconsin)
W79-04787

THE EFFECTS OF AMMONIUM IN WATER ON POTAMOGETON LUCENS,
Tel-Aviv Univ. (Israel). Dept. of Botany.
M. Litav, and Y. Lehrer.
Aquatic Botany, Vol. 5, p 127-128, 1978, 6 tab, 24 ref.

Descriptors: *Aquatic plants, *Toxicity, *Detergents, *Ammonium salts, *Mortality, *Primary productivity, Water pollution effects, Water pollution sources, Ammonium, Nitrogen compounds, Rooted aquatic plants, Hydrogen ion concentration, Laboratory tests, Acidity, Water properties, *Potamogeton, *DBS.

Rooted Potamogeton lucens plants were heavily damaged by NH4+ concentrations of 40 ppm nitrogen, while detached branches were damaged by ammonium concentrations of 10-15 ppm nitrogen. Bubbling of CO2 gas through the water reduced its pH from 8.5 to about 6.0 and this prevented the appearance of ammonium-induced injury symptoms. This effect was explained by the fact that the ionic form of ammonia is much slower to penetrate into cells than the molecular form. Dodecylbenzenesulfonate, when applied to the water in conjunction with an ammonium salt, produced rapid death of the plants. This was probably due to the much increased rate of ammonia uptake, caused by the effect of the detergent on the cell membranes. (Katz-EIS)
W79-04815

ENTRAINMENT OF LARVAL FISH BY THE DOUGLAS POINT GENERATING STATION, LAKE HURON, IN RELATION TO SEASONAL SUCCESSION AND DISTRIBUTION,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
J. R. M. Kelso, and J. K. Leslie.
Journal of the Fisheries Research Board of Canada, Vol. 31, No. 1, p 37-41, 1979. 3 fig, 2 tab, 4 ref.

Descriptors: *Lake Huron, *Nuclear power plants, *Nuclear reactors, Freshwater fish, Larval growth stage, *Juvenile fish, Larval fish, Suckers, Yellow perch, Smelt, Alewife, Sculpin, Entrainment, Cooling water, Douglas Point Generating Station.

Larval fish were sampled by net in Lake Huron and the Douglas Point generating station throughout spring, summer, and early fall 1975. Dominance shifted from fourhorn sculpin to rainbow smelt then to alewife from late April to late September. Entrainment of the major species paralleled dominance and abundance observed in the lake, but yellow perch, brook stickleback, and slimy sculpin caught in the lake - each ranging from 5 to 25% of the total catch - were not entrained. Conversely, white sucker was entrained but not captured in the lake. Size of individuals entrained, upper limit approx. 40 mm, paralleled size of individuals in the lake. Vertical distribution, and thus proximity to the submerged intake, greatly influenced entrainment rate. (Katz-EIS)
W79-04816

AMMONIA TOXICITY AND PH CONTROL IN FISH TOXICITY BIOASSAYS OF TREATED WASTEWATERS,
Los Angeles County Sanitation Districts, Whittier, CA. San Jose Creek Water Quality Lab.
R. Baird, J. Bottomley, and H. Taitz.
Water Research, Vol. 13, p 181-184, 1979. 3 fig, 1 tab, 4 ref.

Descriptors: *Ammonia, *Toxicity, *Bioassay, *Shiners, Hydrogen ion concentration, Fish kills, Carbon dioxide, Waste water(Pollution), Activated sludge, Water chemistry, Mortality, Dissolved oxygen, Nitrogen, Sewage effluents, Methodology, Los Angeles County.

A means of preventing anomalous fish kills in static bioassay testing of ammonia-containing treated wastewaters is described. Low flow O2 is used instead of air in order to prevent O2 stripping, subsequent pH rise and increases in the NH3 levels during the course of the test. (Deal-EIS)
W79-04817

LAKE NEMATODE POPULATION INCREASE FOLLOWING BYPASS OF SECONDARY EFFLUENT,

Cornell Univ. Ithaca, NY. Dept. of Natural Resources.
S. B. Smith.
Journal of the Water Pollution Control Federation, Vol. 51, No. 2, p 406-410, 1979. 1 fig, 2 tab, 9 ref.

Descriptors: Eutrophication, Secondary treatment, Sewage treatment, Benthic fauna, Waste water treatment, Phosphorus, Animal populations, Growth rates, Enteric bacteria, Public health, Ammonia, Chlorine, Pathogenic bacteria, Viruses, New York Canandarago Lake, Richfield Springs, *Nematodes, *Tertiary treatment.

Benthic investigations from Canadarago Lake indicate a definite increase in the nematode population following the initiation of the tertiary treatment process at the plant in Richfield Springs, New York. The benthic nematode increase appears because of the abundance of the nematodes in the aeration lagoons involved with the secondary effluent at the treatment plant, where a build up of small animals (such as rotifers and ciliates) and algae are likely to occur. Periods of bypass from the aeration lagoons to the chlorine contact chamber, in particular, showed evidence of increased nematode populations in the lake benthos. (Deal-EIS)
W79-04818

LEAD ACCUMULATION IN PLANKTON BLOOMS FROM ULLSWATER, THE ENGLISH LAKE DISTRICT,
London Univ. (England). Dept. of Botany; and London Univ. (England). Dept. of Biochemistry.
P. Denny, and R. P. Welsh.
Environmental Pollution, Vol. 18, p 1-9, 1979. 3 tab, 15 ref.

Descriptors: *Lead, *Plankton, *Eutrophication, Heavy metals, Water chemistry, Lakes, Phytoplankton, Zooplankton, Metabolism, Algae, Food chains, Chemical analysis, Path of pollutants, Spectrophotometry, Food webs, *Bioaccumulation, *Bioconcentration.

Concentrations of lead in plankton samples from Ullswater were compared with concentrations in samples from Bassenthwaite Lake and Mockerkin Tarn. Melosira and Asterionella blooms from Ullswater contained up to 772 micrograms Pbg-1, organic dry weight, whilst samples from the other lakes contained 29-167 micrograms Pbg-1. The Ullswater phytoplankton represented a lead concentration factor in excess of 100,000 and possible mechanisms for this are suggested. It was estimated that these algal blooms contributed 1-2 mg Pbm-2 to the sediment. Data from the zooplankton indicated that lead from phytoplankton may have been transferred and accumulated into the zooplankton food chain. (Deal-EIS)
W79-04819

ANNUAL CYCLES OF SOME CLADOCERANS IN A POLLUTED STREAM,
Baghdad Univ. (Iraq). Dept. of Biology.
M-B. M. Mohammad.
Environmental Pollution, Vol. 18, p 71-82, 1979. 7 fig, 2 tab, 27 ref.

Descriptors: *Reproduction, *Daphnia, Annual, Animal physiology, Crustaceans, Broods, Seasonal, Biorhythms, Statistical analysis, Biochemical oxygen demand, Water pollution effects, Domestic wastes, Tubificids, Sewage, *Monia, *Arthropods, Baghdad, Khir River, Iraq.

The purpose is to investigate the effects of pollution on cyclic reproduction of several cladocerans in an extremely sluggish, polluted, streams (Khir River) in Baghdad, the Republic of Iraq. Daphnia magna and Moina brachiata have one sexual phase during the year, while Ceriodaphnia riguadi has two. Simocephalus exspinosus exhibits one or two sexual phases, depending on the amount of pollution in the habitat. Brood-size of the last-named cladocern tends to increase with increase in organic enrichment up to a certain level. Alona costata, Pleuroxus denticulatus, and Chydorus sphaericus propagate in the stream but never in sufficient numbers for reliable determinations of cyclic reproduction. (Deal-EIS)
W79-04820

CYCLOMORPHOSIS IN DAPHNIA CARINATA KING (CRUSTACEA: CLADOCERA) FROM TWO ADJACENT SEWAGE LAGOONS IN SOUTH AUSTRALIA,
Adelaide Univ. (Australia). Dept. of Zoology.
B. D. Mitchell.
Australian Journal of Marine and Freshwater Research, Vol. 29, p 565-576, 1978. 6 fig, 1 tab, 33 ref.

Descriptors: *Seasonal, *Crustaceans, *Sewage lagoons, *Daphnia, Size, Animal physiology, Animal metabolism, Growth stages, Water temperature, Genetics, Adaptation, Biochemistry, Animal populations, Waste treatment, *Cyclomorphosis, *Morphology.

Seasonal changes in morphology are described for D. carinata from two adjacent sewage lagoons in South Australia. Carapace width to body length ratios of a variety of developmental stages showed carapace expansion in adults larger than 2mm during times of the year when water temperature was decreasing. Carapace expansion was primarily dorsal in aspect. Several forms occurred concurrently during periods of morphological change. Cyclomorphosis in D. carinata is discussed in relation to studies on Holarctic Daphnia. (Deal-EIS)
W79-04821

ACCUMULATION OF HEAVY METALS BY THE MARINE DIATOM DITYLUM BRIGHTWELLII (WEST) GRUNOW,
Melbourne Univ., Parkville (Australia). School of Botany.
G. S. Canterford, A. S. Buchanan, and S. C. Ducker.
Australian Journal of Marine and Freshwater Research, Vol. 29, p 613-622, 1978. 6 fig, 3 tab, 31 ref.

Descriptors: *Heavy metals, *Diatoms, *Absorption, *Copper, *Zinc, *Cadmium, *Lead, Plankton, Water chemistry, Chemical analysis, Path of pollutants, Spectrophotometry, Growth rates, *Bioaccumulation, *Bioconcentration.

The accumulation of copper, zinc, cadmium, and lead by the marine planktonic diatom D. brightwellii cultured under laboratory conditions is described. With the exception of copper, the concentration of metal taken up by D. brightwellii generally increased with increasing concentration of the metal in the medium. From calculated biological concentration factors (BCF), metal uptake was in the order Zn>PB>Cu>Cd. For each metal, the BCF value and percentage uptake generally decreased with increasing metal concentration in the medium. (Deal-EIS)
W79-04822

EFFECTS OF TEMPERATURE AND SALINITY ON THE LIFE CYCLE OF OPHRYOTROCHA DIADEMA (POLYCHAETA, DORVILLEIDAE),
Goteborg Univ. (Sweden). Dept. of Zoology.
B. Akesson, and J. D. Costlow.
Ophelia, Vol. 17, No. 2, p 215-229, 1978. 6 fig, 10 tab, 13 ref.

Descriptors: *Salinity, *Water temperature, *Toxicity, Reproduction, Growth stages, Larval growth stage, Mortality, Fertility, Life cycles, Life history studies, Growth rates, Animal physiology, *Polychaetes.

Experiments were performed in 5% steps of salinity from 15 to 45% combined with temperatures of 15, 18, 21 and 25C. At salinities of 15 and 20% all animals, both adults and larvae, died within two days. In the remaining 20 salinity/temperature combinations adults were kept for 3 weeks and larvae for a minimum of one month or until they were sexually mature. For adults, mortality, number and size of egg masses, and reproductive success were recorded. Corresponding parameters for larvae were mortality, growth rate and time to beginning of reproduction. Optimum conditions for survival were obtained at 35% salinity and 18C. The optimum for egg production (reproductive rate) was 35% and 25C. The maximum growth rate was observed at 30 and 35% salinity and 25C. These two combinations also represented the shortest time of development to sexual maturity. The number of eggs per egg mass was significantly salinity dependent, with an optimum at 35%, but was not affected by temperature, except at 40% salinity, or by salinity/temperature interaction. (Deal-EIS)
W79-04823

PARALYTIC SHELLFISH TOXINS IN THE SEA SCALLOP, PLACOPECTEN MAGELLANICUS, IN THE BAY OF FUNDY,
Rhode Island Univ., Kingston. Coll. of Pharmacy.
For primary bibliographic entry see Field 5A.
W79-04825

STUDIES ON TOXIC EFFECTS OF PESTICIDES ON FISH - II TOXIC EFFECTS OF THE HERBICIDE, BENTHIOCARB, ON CARP. (IN JAPANESE),
Mie Prefectural Univ., Tsu (Japan). Faculty of Fisheries.
T. Ochiai, and S. S. Kubota.
Bulletin of the Faculty of Fisheries, Mie University, No. 5, p. 155-163, 1978. 1 fig, 2 tab, 7 ref. (English abstract).

Descriptors: *Fish disease, *Animal pathology, *Herbicides, *Toxicity, *Mortality, Water pollution effects, Fish physiology, Bioassay, Lethal limit, Carp, Water pollution effects, Pesticides, Toxins, *Benthiocarb, *Histology, Hematology, Hemorrhage, Hemoglobin.

The toxic effects of the herbicide, benthiocarb, on carp were investigated. All the carp died within 14 days after continuous exposure to benthiocarb at 3.2 and 1.8 ppm, but 75% of the carp survived at 1.0 ppm for 21 days. Anemia was found in the carp exposed to benthiocarb at 1.8 and 1.0 ppm. It was expressed as a decrease of the red blood cell count, hemoglobin volume, and hematocrit value. The long axis of mature erythrocytes in the anemic carp tended to be shorter. In the anemic carp, hemosiderin deposit intensively increased in the spleen and the head kidney. In both anemic and non-anemic carp exposed to 1.8, 1.0 and 0.56 ppm, spherical bodies were extensively observed throughout the liver. The walls of these bodies could be stained with pyronin, but several methods failed to stain their contents. In both anemic and non-anemic carps at 3.2, 1.8 and 1.0 ppm, hemorrhage was seen in the lamina propria of the intestine. Thus, it is considered that the toxic effects of benthiocarb on carp are anemia, degeneration of hepatic cells and hemorrhage in the intestine. (Katz-EIS)
W79-04826

EFFECTS OF SIMAZINE TREATMENT ON CHANNEL CATFISH AND BLUEGILL PRODUCTION IN PONDS,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
C. S. Tucker, and C. E. Boyd.
Aquaculture, Vol. 15, p. 345-352, 1978. 6 fig, 2 tab, 13 ref.

Descriptors: *Channel catfish, *Aquiculture, Productivity, *Dissolved oxygen, *Herbicides, *Farm ponds, *Aquatic weed control, Sunfishes, Commercial fish, Phytoplankton, Bottom sediments, Fish farming, Fish management, Pesticides, Plant growth regulators, Algae, Growth rates, *Simazine, *Ictalurus, *Lepomis, Fish yield.

Application of 13.4 kg/ha of simazine to the bottoms of channel catfish (Ictalurus punctatus) ponds before flooding resulted in an extended period of low dissolved oxygen, a significant reduction of 19% in channel catfish yield, and poorer feed conversion by fish when compared to control ponds. A single application of 1.5 mg/l of simazine to the water of fertilized bluegill (Lepomis macrochirus) ponds also decreased dissolved oxygen.

The 11% reduction in bluegill yield was not statistically significant. Simazine treatment caused an initial reduction in macrophyte coverage in bluegill ponds, but macrophyte coverage increased as simazine concentrations in the pond water declined. (Katz-EIS)
W79-04827

STUDIES ON TOXIC EFFECTS OF PESTICIDES ON FISH-I. TOXIC EFFECTS OF THE HERBICIDE, MOLINATE, ON CARP,
Mie Prefectural Univ., Tsu (Japan). Faculty of Fisheries.
T. Ochiai, and S. S. Kubota.
Bulletin of the Faculty of Fisheries, Mie University, No. 5, p. 129-153, 1978. 3 fig, 11 tab, 25 ref. (English abstract).

Descriptors: *Fish diseases, *Pathology, *Herbicides, *Toxicity, *Mortality, *Mode of action, Water pollution effects, Biochemistry, Fish physiology, Carp, Vitamins, Bioassay, Pesticides, Nutrient requirements, Analytical techniques, *Coagulation factors, *Anemia, *Hemorrhage, *Vitamin K, *Hematology, *Molinate.

The toxic effect of the herbicide, molinate, on carp arises from hemmorhagic anemia resulting from hemorrhages occurring mainly in the gill. No cytological change was observed in the blood of anemic carp except for increased immature erythrocytes. Bleeding time, plasma prothrombin time, and partial thromboplastin time of the exposed carp's blood were prolonged in proportion to the duration of exposure. These facts indicated that a blood coagulation factor of the exposed carp was obstructed. The obstructed coagulation factor was named 'M factor' and resembles the X factor, of human blood. Food containing vitamin K was highly effective in preventing hemorrhagic anemia in the exposed carp. Both vitamin K3 and K4 were suited for this purpose. The toxic effects of molinate on carp were increased if carp were first exposed to 0.8 ppm nifulpyrinol. (Katz-EIS)
W79-04828

SOME EFFECTS OF GAS-SUPERSATURATED SEAWATER ON SPISULA SOLIDISSIMA AND ARGOPECTEN IRRADIANS,
National Marine Fisheries Service, Milford, CT. Experimental Biologial Investigations.
R. Goldberg.
Aquaculture, Vol. 4, p. 281-287, 1978. 2 fig, 2 tab, 10 ref.

Descriptors: *Aquiculture, *Clams, *Commercial shellfish, *Supersaturation, *Oxygen, *Mollusks, Invertebrates, Shellfish, Nitrogen, Mortality, Animal pathology, Diseases, Environmental effects, Lethal limit, Animal behavior, *Scallops, *Spisula, *Argopecten, *Gas supersaturation, *Bivalves, *Gas-bubble disease.

Two size classes of the surf clam, Spisula solidissima, and the bay scallop, Argopecten irradians, were exposed to different concentrations of gas-supersaturated seawater in a flowing seawater system. Both species tested experienced no mortality when held in the control treatment maintained at 96% oxygen and 109% nitrogen. Mortality, gill tissue damage, gas emboli, membranous tissue blisters, and abnormal secretion of shell material were induced experimentally at elevated levels of gas supersaturation. Results indicate significant mortalities of surf clams and scallops held at 114% oxygen and 195% nitrogen, and at higher levels of gas concentration. These values suggest a point of reference for the bivalve culturist in identifying potential problems which can be caused by gas-supersaturated seawater. (Katz-EIS)
W79-04829

AUTOTROPHIC AND HETEROTROPHIC PRODUCTION OF MICROORGANISMS IN INTENSELY-MANURED FISH PONDS, AND RELATED FISH YIELDS,
Agricultural Research Organization, Dor (Israel). Fish and Aquaculture Station.
G. L. Schroeder.
Aquaculture, Vol. 14, p. 303-325, 1978. 2 fig, 7 tab, 40 ref.

Descriptors: *Aquiculture, *Fish food organisms, *Aquatic microorganisms, *Fish diets, *Food chains, *Farm wastes, *Carp, Dissolved oxygen, Respiration, Benthos, Tilapia, Protozoa, Aquatic bacteria, Fertilizers, Organic matter, Growth rates, productivity, Primary productivity, On-site investigation, Water quality, *Nitrogen sources, *Feed conversion ratio.

Intensely-manured ponds produce 15-30 kg fish/ha/day with cow or chicken manure and nitrogen- and phosphate-rich fertilizers as the only nutritional inputs. The manure as it is supplied to the ponds is not a good fish food and does not produce good fish growth. Quantitative analysis shows that the production of all organisms, autotrophic and heterotrophic, pelagic and benthic, large enough to be used directly by the fish (i.e., larger than 37 microns) is adequate to account for less than half of the measured fish growth. Production within the microbial community that flourishes on and rapidly digests the manure organic matter is adequate to produce the measured fish growth. The fish appear to harvest the microorganisms at the level of bacteria and protozoa, by ingesting the small straw-like particles which comprise much of the manure and serve as the substrate for the microbial growth. (Katz-EIS)
W79-04831

THE INFLUENCE OF TEMPERATURE AND WET WEIGHT ON THE OXYGEN DEMAND OF RAINBOW TROUT (SALMO GAIRDNERI R.) IN FRESH WATER,
Electricite de France, Paris, Direction de l'Equipment.
A. Muller-Feuga, J. Petit, and J. J. Sabaut.
Aquaculture, Vol. 14, p 355-363, 1978. 2 tab, 4 fig, 11 ref.

Descriptors: *Rainbow trout, *Bioassay, *Water temperature, *Oxygen demand, *Aquiculture trout, Salmonids, Respiration, Environmental effects, Size, Weight, Metabolism, Mathematical studies, Regression analysis, Fish physiology, Oxygen, Salmo gairdneri, Feeding levels, Activity ratio.

Multiple regression analysis was applied to a series of oxygen demand measurements on rainbow trout. It confirmed the determinant influence of temperature and size of fish under standard feeding conditions. Two types of adjustment of oxygen demand in relation to those two factors were tested, and one of them was choosen in which the temperature is under an exponential form. This allows the introduction of the Q10 concept, an activity ratio. The value of Q10 is 3.5 when the water temperature is below 10C and 1.7 above 12C. (Katz-EIS)c
W79-04832

ACUTE TOXICITY OF COPPER, ZINC AND MANGANESE IN SINGLE AND MIXED SALT SOLUTIONS TO JUVENILE LONGFIN DACE, AGOSIA CHRYSOGASTER,
Arizona State Univ., Tempe. Dept. of Zoology.
M. Lewis.
Journal of Fish Biology, Vol. 13, p 695-700, 1978. 1 fig, 3 tab, 17 ref.

Descriptors: *Toxicity, *Copper, *Zinc, *Manganese, *Mine wastes, Juvenile growth stage, Mortality, Metals, Fish physiology, Heavy metals, Salts, Mine water, Chemical wastes, Freshwater fish, Bioassay, *Agosia, *Longfin Dace.

The acute toxicity of copper, zinc and manganese and copper-zinc and copper-manganese mixtures were determined for juvenile longfin dace in hard water bioassays. Copper-zinc was the most lethal toxicant and exhibited a more than additive toxicity which was in contrast to the additive toxicity of copper-manganese mixtures. The toxicity of copper and zinc to the fish was similar but both were considerably more lethal than manganese. (Deal-EIS)
W79-04833

THE EFFECTS OF SOME POLLUTANTS ON THE SURVIVAL, GROWTH AND RESPIRATION OF LAMINARIA HYPERBOREA,
Liverpool Univ. (England). Dept. of Marine Biology.
R. Hopkins, and J. M. Kain.
Estuarine and Coastal Marine Science, Vol. 7, No. 6, p 531-553, 1978. 12 fig, 5 tab, 46 ref.

Descriptors: *Growth rates, *Respiration, *Phaeophyta, *Toxicity, Water pollution effects, Heavy metals, *Cadmium, *Zinc, *Mercury, *Copper, Organic compounds, Detergents, Pesticides, Herbicides, 2,4-D, Phenols, Growth stages, Cytological studies, *Marine plants, *Survival.

The effects of seventeen pollutants, including metals, herbicides and detergents were measured in the laboratory by culturing the young stages and measuring the respiration rates of discs of mature frond tissue of Laminaria hyperborea. The pollutants tested were: mercury; copper; zinc; cadmium; atrazine; dalapon; MCPA; 2,4-D; phenol; sodium pentachlorophenate; 2 detergent mixtures; sodium lauryl ether sulfate; sodium dodecyl benzene sulfonate; coconut fatty acid diethanolamide; pluronic; and DOBS55. Tests were also conducted using polluted seawater collected from the coast of N.E. England. (Deal-EIS)
W79-04834

CHRONIC EXPOSURE OF CHANNEL CATFISH, ICTALURUS PUNCTATUS, TO AMMONIA: EFFECTS ON GROWTH AND SURVIVAL,
California Univ., Davis. Dept. of Civil Engineering.
J. Colt, and G. Tchobanoglous.
Aquaculture, Vol. 15, p 353-372, 1978. 5 fig, 3 tab, 59 ref.

Descriptors: *Channel catfish, *Ammonia, *Nitrogen compounds, *Growth rates, Nitrogen cycle, Juvenile growth stage, Mortality, Toxicity, Aquiculture, Commercial fish, Lethal limit, Water pollution sources, Water pollution effects, Water quality, Environmental effects, Laboratory tests, Bioassay, *Ictalurus punctatus, *Sublethal effects.

The growth of juvenile channel catfish (Ictalurus punctatus) was reduced in a linear manner during a 31 day growth trial when exposed to concentrations of ammonia ranging from 48 to 989 microgr/l NH3-N (0.31 to 5.71 mg/l NH+4-N). On a wet weight basis, growth was reduced by 50% at 517 microgr/l NH3-N and the no growth occurred at 967 microgr/l. The no growth level was 60% of 96-h LC50 value. Mortality was increased significantly at 989 microgr/l NH3-N and above. The sublethal effects of ammonia may depend, in part, on the concentrations of NH+4 and Na+ in solution. (Katz-EIS)
W79-04835

ZINC CONTENT OF THE GILLS OF RAINBOW TROUT (S. GAIRDNERI) AFTER TREATMENT WITH ZINC SOLUTIONS UNDER NORMOXIC AND HYPOXIC CONDITIONS,
Bristol Univ. (England). Research Unit for Comparative Animal Respiration.
G. M. Hughes, and R. Flos.
Journal of Fish Biology, Vol. 13, p 717-728, 1978. 5 fig, 4 tab, 32 ref.

Descriptors: *Rainbow trout, *Zinc, *Toxicity, Fish physiology, Water chemistry, Chemical analysis, Heavy metals, Path of pollutants, Oxygen, Dissolved oxygen, Absorption, Chemical reactions, Enzymes, *Tissue analysis, *Gills.

Forty specimens of rainbow trout were divided into 4 groups which were treated as follows: (a) normoxic clean water; (b) hypoxic clean water; (c) normoxic water with 10 ppm zinc for 10 h; (d) hypoxic water with 10 ppm zinc for 10 h. The zinc content was determined separately for each of the 4 gill arches on each side of the fish. Values for the zinc concentration were greater following the zinc treatments, but no significant difference between hypoxia and normoxia was observed. Differences in concentrations of zinc were found in different

arches whether expressed per gram dry weight or per unit surface area of the secondary lamellae. (Deal-EIS)
W79-04836

TOXIC EFFECTS OF ZINC ON FATHEAD MINNOWS PIMEPHALES PROMELAS IN SOFT WATER,
Environmental Research Lab., Duluth, MN.
D. A. Benoit, and G. W. Holcombe.
Journal of Fish Biology, Vol. 13, p. 701-708, 1978. 3 tab, 24 ref.

Descriptors: *Zinc, *Toxicity, *Minnows, Life cycles, Life history studies, Fish eggs, Growth stages, Spawning, Fish reproduction, Larval growth stage, Resistance, Heavy metals, Bioassay, Fish physiology, Bioassay, Methodology, *Pimephales.

A fathead minnow life-cycle exposure to various zinc concentrations demonstrated that the most sensitive indicators of zinc toxicity were egg adhesiveness and fragility, which were significantly affected at 145 micrograms Zn 1-1 and above, but were not affected at 78 micrograms Zn 1-1 and below. These effects occurred shortly after the eggs were spawned (during water hardening) and therefore were not related to effects on the parental fish. Hatchability and survival of larvae were significantly reduced, and deformities at hatching were significantly increased at 295 micrograms Zn 1-1 and above. Acclimated and unacclimated groups of larvae exposed to identical zinc concentrations for 8 weeks after hatch showed only slight differences in sensitivity. (Deal-EIS)
W79-04837

THE GROWTH AND BIOMASS DISTRIBUTION OF TWO EMERGENT FRESHWATER PLANTS, CYPERUS ESCULENTUS AND SCIRPUS VALIDUS, ON DIFFERENT SEDIMENTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
J. W. Barko, and R. M. Smart.
Aquatic Botany, Vol. 5, p. 109-117, 1978. 1 fig, 5 tab, 24 ref.

Descriptors: *Growth rates, *Biomass, *Bottom sediments, *Aquatic plants, *Plant growth, *Rooted aquatic plants, Primary productivity, Sediments, Aquatic soils, Laboratory tests, Clays, Coarse sediments, Sand, Nutrients, Particle size, Adsorption, Nitrogen, Phosphorus, *Cyperus, *Scirpus, Emergent plants, Nutrient availability.

The growth of two emergent freshwater plants, Cyperus esculentus and Scirpus validus, was investigated under greenhouse control in a simulated freshwater marsh environment. Plants were grown on one coarse and two fine-textured sediments differing significantly in phosphorus and nitrogen contents. Growth of both species, measured as total biomass accrual during a two-month period, was greatest on silty clay, intermediate on clay, and least on sand. Both shoot density (number of shoots per area) and the specific mass of individual shoots with regard to sediment type demonstrated patterns identical to that of total biomass. Below to above ground biomass ratios were inversely related to plant growth. The fine-textured sediments provided proportionately greater above ground growth than the sand. Analysis of plant shoots indicated possible growth limitation by nitrogen on clay. Growth on silty clay was limited by neither nitrogen nor phosphorus, which were both present in the highest concentrations in this sediment. The biomass of both species on silty clay was within the range of most published estimates of the biomass of emergent freshwater plants in temperate regions of the world (Katz-EIS)
W79-04838

TRACE METALS IN THE COMMON MUSSEL, MYTILUS EDULIS (L.), AND IN THE ALGA FUCUS VESICULOSUS (L.) FROM THE REGION OF THE SOUND (ORESUND),
Uppsala Univ. (Sweden). Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W79-04840

EDIBLE-OIL POLLUTION ON FANNING ISLAND,
Hawaii, Univ., Honolulu. Dept. of Botany.
For primary bibliographic entry see Field 5B.
W79-04841

THE EFFECTS OF HEATED EFFLUENTS ON THE PRODUCTION OF MARINE PLANKTON (TAKAHAMA NUCLEAR POWER STATION-I) (IN JAPANESE),
Seikai Regional Fisheries Research Lab., Nagasake (Japan).
For primary bibliographic entry see Field 5B.
W79-04842

POLLUTION OF A WATER SUPPLY CATCHMENT BY BREEDING GULLS AND THE POTENTIAL ENVIRONMENTAL HEALTH IMPLICATIONS,
North West Water Authority (England).
For primary bibliographic entry see Field 5B.
W79-04843

ACUTE TOXICITY OF 12 INDUSTRIAL CHEMICALS TO FRESHWATER AND SALTWATER ORGANISMS,
Rice Univ., Houston, TX. Dept. of Biology; and Rice Univ., Houston, TX. Dept. of Environmental Science and Engineering.
For primary bibliographic entry see Field 5A.
W79-04845

A NEW AQUARIUM FOR THE STUDY OF TEMPERATURE BEHAVIOUR OF FISH,
Norsk Inst. for Vannforskning, Blindern (Norway).
For primary bibliographic entry see Field 5A.
W79-04846

USE OF CHLORINE TO CONTROL OTEC BIOFOULING,
Ecological Analysts, Inc., Melville, NY.
For primary bibliographic entry see Field 5B.
W79-04847

FLUX OF CERTAIN RADIONUCLIDES IN THE BLOOD-CLAM ANADARA GRANOSA LINNEAUS UNDER ENVIRONMENTAL CONDITIONS,
Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.
For primary bibliographic entry see Field 5A.
W79-04849

ENVIRONMENTAL QUALITY RESEARCH. USE OF UNICELLULAR ALGAE FOR EVALUATION OF POTENTIAL AQUATIC CONTAMINANTS. SECOND ANNUAL REPORT,
California Univ., Irvine.
For primary bibliographic entry see Field 5A.
W79-04850

TEMPERATURE INFLUENCES ON GROWTH OF AQUATIC ORGANISMS,
Oak Ridge National Lab., TN.
C. C. Coutant, and J. S. Suffern.
Available from the National Technical Information Service, Springfield, VA 22161 as CONF-770516-9, Price codes: A02 in paper copy, A01 in microfiche. 1978. 13 p, 4 fig, 9 ref.

Descriptors: *Water temperature, *Growth rates, *Aquiculture, Aquatic life, Cooling water, *Thermal pollution, Heated water, Bass, Fish physiology, Animal metabolism, Effluents, Thermal stress.

Temperature profoundly affects the growth rates of aquatic organisms, and its control is essential for effective aquaculture. Characteristically, both low and high temperatures produce slow growth rates and inefficient food conversion, while intermediate temperature ranges provide rapid growth and efficient food conversion. Distinct, species-specific optimum temperatures and upper and lower temperatures of zero growth can often be defined. Thermal effects can be greatly modified by amounts and quality of food. These data not only provide the basis for criteria for maintaining growth of wild organisms but also for effectively using waste heat to create optimal conditions of temperature and food ration for growing aquatic organisms commercially. (Deal-EIS)
W79-04851

THE DISTRIBUTION AND ABUNDANCE OF SUBMERGED AQUATIC MACROPHYTES IN A REACTOR COOLING RESERVOIR,
Dupont de Nemours (E. I.) and Co., Aiken, SC. Savannah River Lab.
For primary bibliographic entry see Field 5B.
W79-04880

ADDED CHLORINE IN AQUATIC ENVIRONMENTS,
Tennessee Univ., Knoxville. Dept. of Engineering Science and Mechanics.
E. V. Kalmaz.
The Journal of Environmental Sciences, Vol 21, No. 5/6, p 30-32, May/June 1978. 15 ref.

Descriptors: *Water pollution effects, *Chlorine, *Environmental effects, Resources development, Marine animals, Outer Continental Shelf, Reproductive failure, Chloramines.

The release of chlorinated water is producing effects that are slowly being better documented as a result of continuing research. The results of the recent studies show avoidance behavior and reproductive failure in fresh water invertebrates and fish at chlorine concentrations of .003 mb/l to .005 mg/l. Most of the regulations have been based on measurements of residual chlorine for both control of wastewater treatment and effluent limitations on power plants. Considering the strong sensitivity of aquatic organisms to residual chlorine and the present levels of chlorine use, substantial damage to aquatic resources may occur. The results of the studies of Duursma and others show that the chemistry of chlorine in estuarine and sea water is exceedingly complex, resulting in unique problems in analysis and interpretation of results. (Sinha-OEIS)
W79-04899

FLARE UP OVER NORTH SEA BIRDS,
B. Sage.
New Scientist, p 464-466, February 15, 1979. 1 photo.

Descriptors: *Water pollution effects, *Birds, Mortality, Oil pollution, Resources development, Environmental effects, Outer Continental Shelf, North Sea, Gas flares.

The Edinburgh office of the Royal Society for the Protection of Birds (RSPB) heard that early in October 1973, 'several hundred' storm-petrels were incinerated in a gas flare on a drilling rig in Shetland waters. According to this report, the carnage was so great that it was necessary to hose down the structure around the flare stack. From the information now available it is clear that a large number of birds have been killed at gas flares on exploration rigs and production platforms in the North Sea since at least 1973. With the exception of the storm petrel incident in Shetland in 1973, the reports have referred mainly to night-migrating land birds. October appears to be the critical time, and the incidents evidently occur on nights when it is damp with mist or light fog. (Sinha-OEIS)
W79-04900

A SIMPLE METHOD FOR SCREENING PETROLEUM EFFLUENTS BY IN VITRO ENZYME INHIBITION,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology; and Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.

C. L. Rutherford, A. L. Buikema, Jr., D. R. Armant, and J. Cairns, Jr.
Bulletin of Environmental Contaminant Toxicology, Vol. 21, p 79-84, 1979. 1 fig, 2 tab, 7 ref.

Descriptors: *Resources development, *Water pollution effects, *Enzymes, On-site tests, Environmental effects, Industrial wastes, *Outer Continental Shelf, Petroleum.

With the need to evaluate the environmental hazards of industrial wastes, there is increased demand for methods for quickly screening industrial effluents to determine if more sophisticated tests are needed, and, if they are, to establish priorities. While the animal systems currently being used for biological assessment are the best criteria for the final judgment of toxicant effect, simpler and less expensive methods for an initial on-site screening may be useful. The present research was aimed at developing a rapid and inexpensive method for screening of petroleum effluents. A procedure is described for determining the extent of enzyme inhibition by a simulated petroleum effluent which contained 'conventional contaminants.' (Sinha-OEIS)
W79-04902

OIL SPILLS: THE STRATEGY OF RECOVERY,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Economics.
J. M. Conrad.
Coastal Zone Management Journal, Vol. 4, No. 4, p 409-434, 1978. 2 fig, 8 tab, 6 ref.

Descriptors: *Oil spills, *Coasts, *Massachusetts, Water quality control, Water pollution control, Model studies, *Outer Continental Shelf, Recovery operations, Georges Bank.

A rational approach for determining the level and location of resources for recovery of oil from a nearshore spill is established. Its perspective is one of cost-effectiveness: If OCS development is to take place and recoverable reserves are found, how should oil spill recovery resources be deployed so as to minimize the impact of a nearshore spill. A general model for location of recovery resources is presented. The model is constructed so as to incorporate (1) indices of 'spill sensitivity' for different zones along a coastline, (2) spill probabilities for each zone, and (3) recovery rates based on initial location of recovery resources and deployment time. The problem of optimal location may be considered as an optimization problem where the instruments variables are deployment of 'recovery packages.' The problem then becomes one of locating such packages so as to minimize the expected damage from unrecovered oil, subject to resource availability and recovery technology. The general model is applied to coastal Massachusetts. Nine hypothetical situations are constructed, and an optimal deployment strategy is developed for each. The level of recovery commitment, which could be justified in terms of damage reduction is considered and alternative financial and operational arrangements that might be employed to provide the desired recovery potential are suggested. (Sinha - OEIS)
W79-04904

HABITAT DEVELOPMENT FIELD INVESTIGATIONS, BOLIVAR PENINSULA MARSH AND UPLAND HABITAT DEVELOPMENT SITE, GALVESTON BAY, TEXAS; APPENDIX D: PROPAGATION OF VASCULAR PLANTS AND POST-PROPAGATION MONITORING OF BOTANICAL, SOIL, AQUATIC BIOTA, AND WILDLIFE RESOURCES,
Texas Agricultural Experiment Station, College Station.
For primary bibliographic entry see Field 5E.
W79-04927

AQUATIC DISPOSAL FIELD INVESTIGATIONS, DUWAMISH WATERWAY DISPOSAL SITE, PUGET SOUND, WASHINGTON; APPENDIX D: CHEMICAL AND PHYSICAL ANALYSES OF WATER AND SEDIMENT IN RELATION TO DISPOSAL OF DREDGED MATERIAL IN ELLIOTT BAY, VOL. I, FEB - JUNE 1976,
Corvallis Environmental Research Lab., OR. Marine and Freshwater Ecology Branch.
D. J. Baumgartner, D. W. Schults, and J. B. Carkin.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-77-24, June 1978 (in two volumes). 215 p, 8 tab, 27 fig, 6 ref, 6 append.

Descriptors: *Washington, *Aquatic environment, *Water analysis, *Waste disposal, *Bottom sediment, *Elliott Bay(WASH), *Dredged material disposal, *Waste disposal sites.

Over 100,000 m3 of dredged Duwamish River sediment were deposited in a controlled environmental dump site in Elliott Bay. Results obtained by monitoring physical and chemical parameters in the water column and sediment were evaluated regarding the effects of dredged material disposal in open estuarine waters. Parameters monitored in the water column included: suspended solids, pH, NH3-N, NO2 + nO3, ortho PO4-P, Cr, Hg, As, and Mn. Parameters monitored in the sediment included: moisture content, Eh, organic C, NH3-N, ortho PO4-P, alkaline soluble S, bulk and interstitial Cr, As, Mn, Hg, and particle size distribution. The monitoring program was conducted before, during, and at several intervals after dumping to determine the temporal and spatial impact associated with dumping activity. Data obtained showed dredged material fell rapidly to the seabed when discharged from the barge. Manganese, suspended solids, and ammonia were found to be above ambient in the water column at near-bottom sampling point. Manganese levels were equal to recommended limit, but such levels were found only shortly following each dump and is not expected to represent an ecological hazard. Long-term water quality monitoring showed only a small increase in suspended solids concentration near the bottom. (See also W79-04929) (WES)
W79-04928

VERTICAL MIGRATION OF BENTHOS IN SIMULATED DREDGED MATERIAL OVERBURDENS; VOL. I: MARINE BENTHOS,
Delaware Univ., Lewes. Marine Studies Complex.
For primary bibliographic entry see Field 5E.
W79-04931

DEVELOPMENT OF PROCEDURES FOR SELECTING AND DESIGNING REUSABLE DREDGED MATERIAL DISPOSAL SITES,
Acres American Inc., Buffalo, NY.
For primary bibliographic entry see Field 5E.
W79-04934

EVALUATION OF ALUMINUM SULFATE FOR PHOSPHORUS CONTROL IN EUTROPHIC LAKES,
Kent State Univ., OH. Dept. of Biological Sciences.
G. D. Cooke.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 989, Price codes: A04 in paper copy, A01 in microfiche. Report, January 1979. 51 p, 5 fig, 19 tab, 39 ref. OWRT A-053-OHIO(1).

Descriptors: *Eutrophication, *Phosphorus, Lake restoration, Aluminum sulfate, Trophic state, Nutrient inactivation.

The response of eutrophic lakes to nutrient diversion is often less than expected because many lakes have internal recycling which keeps phosphorus (P) levels high enough to continue nuisance algal blooms. For these a restoration technique is required to achieve desired trophic state. This report describes the effectiveness of a hypolimnetic application of aluminum sulfate to Dollar Lake in 1974 and West Twin Lake (Ohio) in 1975 to control the release of P from anaerobic sediments. Septic tank diversion occurred in 1971. Lake monitoring in 1976 and 1978 supports the conclusion that alum application sharply curtailed internal P release and that P concentrations in the epilimnion and the whole lakes declined due to treatment. Epilimnetic P concentrations are less than half of pre-treatment years, and the lakes have very low cell volumes, an increase in abundance of phyla other than Cyanophyta, low chlorophyll, and higher transparency. The downstream untreated East Twin Lake improved in 1978 due to water of low P content from West Twin. The Carlson Trophic State Index shows that West Twin and Dollar Lakes were mesotrophic by 1976 and East Twin Lake by 1978. The treatment is effective for at least four years but some internal P release continues, supporting the belief that there are significant littoral P sources. A significant decline in the H' diversity of planktonic microcrustacea occurred after treatment.
W79-04958

STUDIES ON THE UPTAKE OF CADMIUM BY THE CRAB CARCINUS MAENAS IN THE LABORATORY. I. ACCUMULATION FROM SEAWATER AND A FOOD SOURCE,
Queen Mary Coll., London(England). Dept. of Zoology and Comparative Physiology.
For primary bibliographic entry see Field 5A.
W79-04968

STUDIES ON THE UPTAKE OF CADMIUM BY THE CRAB CARCINUS MAENAS IN THE LABORATORY. II. PRELIMINARY INVESTIGATION OF CADMIUM-BINDING PROTEINS,
Queen Mary Coll., London (England). Dept. of Zoology and Comparative Physiology.
For primary bibliographic entry see Field 5A.
W79-04969

OCCURRENCE OF A NEW TYPE OF SHELLFISH POISONING IN THE TOHOKU DISTRICT,
Tohoku Univ., Sendai (Japan). Lab. of Food Hygiene.
For primary bibliographic entry see Field 5A.
W79-04970

EFFECT OF COPPER ON VOLUME REGULATION IN THE MARINE FLAGELLATE DUNALIELLA MARINA,
Miljostyrelsen, Charlottenlund (Denmark). Marine Pollution Lab.
H. U. Riisgard.
Marine Biology, Vol. 50, p 189-193, 1979. 3 fig, 16 ref.

Descriptors: *Copper, *Biological membranes, *Toxicity, Membrane processes, Ion exchange, Permselective membranes, Osmosis, Sodium, Potassium, Chlorine, Metals, Cytological studies, Biochemistry, Salinity, Animal physiology, *Flagellates, *Dunaliella.

The marine flagellate Dunaliella marina responds to hypotonic media in the same way as animal cells: an initial phase of osmotic swelling occurs, followed by a second, more prolonged phase of cell shrinkage - the volume-regulation phase. D. marina also volume-regulates in hypertonic media. This does not usually occur in animal cells exposed to normal concentrations of K+. Copper concentrations of 2 ppm and higher inhibit regulation of cell volume in D. marina transferred to hypotonic media. This is probably due to reduced cell-membrane permeability to K+ and/or C1- and not to an interference with Na+/K+ exchange pump. These findings suggest that volume regulation is functionally independent of the Na+/K+ exchange pump. The method described herein appears to be a suitable biotest for pollutants, providing specific information on their effects on the permeability of cell membrane. (Deal-EIS)
W79-04972

CADMIUM TURNOVER IN THE SHORE CRAB CARCINUS MAENAS,
Newcastle-upon-Tyne Univ. (England). Dept. of Zoology.

For primary bibliographic entry see Field 5B.
W79-04973

HEAVY METAL ACTION ON TRANSINTEGUMENTARY ABSORPTION OF GLYCINE IN TWO ANNELID SPECIES,
Biologische Anstalt Helgoland, Hamburg (Germany, F.R.).
D. Siebers, and U. Ehlers.
Marine Biology, Vol. 50, p 175-179, 1979. 4 fig, 15 ref.

Descriptors: *Heavy metals, *Absorption, *Annelids, Oligochaetes, *Mercury, *Cadmium, Salts, Copper, Toxicity, Digestion, Animal physiology, Animal metabolism, Radioactivity techniques, Carbon radioisotopes, Inhibition, Biochemistry, Amino acids, *Chromium, *Iron, *Lead, *Aluminum, *Nickel, *Manganese, *Cobalt, *Zinc, *Polychaetes, *Nereis, *Enchytraeus, *Silver, Glycine.

Absorption of 14C-glycine from ambient sea water across the body surface of the oligochaete Enchytraeus albidus was, after 6 h preincubation, significantly reduced in the presence of 0.1 to 0.15 ppm mercury, 0.25 ppm copper, 1.5 ppm silver, and 2 ppm cadmium. Addition of heavy metal salts reduced maximum uptake rates without affecting transport constants. Influx of 14C-glycine remained unchanged in the presence of up to 10 ppm aluminum, chromium, iron, lead, molybdenum, vanadium, and zinc. Effects of up to 150 ppm nickel, manganese, cobalt and selenium were negligible. Inhibition of glycine absorption by mercury and cadmium in the polychaete Nereis diversicolor is almost identical with results presented for E. albidus. Transintegumentary solute absorption in soft-bodied marine invertebrates obviously represents a suitable biological function for studies on heavy metal toxicity. The close relationship between rates of heavy metal absorption, inhibition of transintegumentary glycine uptake, and acute toxicity is discussed. (Deal-EIS)
W79-04974

UPTAKE FROM WATER AND TISSUE DISTRIBUTION OF NEPTUNIUM-237 IN CRABS, SHRIMP AND MUSSELS,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
For primary bibliographic entry see Field 5A.
W79-04975

DETERMINATION OF PETROLEUM HYDROCARBONS IN WATER, FISH AND SEDIMENTS FOLLOWING THE EKOFISK BLOWOUT,
Ministry of Agriculture, Fisheries and Food, Burnham-on-Crouch (England). Fisheries Lab.
For primary bibliographic entry see Field 5A.
W79-04976

5D. Waste Treatment Processes

ULTRAFILTRATION: A POTENTIAL METHOD TO TREAT POULTRY PROCESSING WASTEWATER WITH PROTEIN RECOVERED AS THE BY-PRODUCT,
North Carolina State Univ. at Raleigh. Dept of Poultry Science.
J. C. H. Shih.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 575, Price codes: A02 in paper copy, A01 in microfiche. The University of North Carolina, Raleigh, Completion Report, (1979). 10 p, 3 fig, 4 tab. OWRT A-100-NC(1).

Descriptors: Membrane ultrafiltration, *Poultry wastes, Poultry processing, Wastewater treatment, *Filtration.

Membrane ultrafiltration (UF) is a technique widely used today in industries and biochemical laboratories in the process of concentration and separation of macromolecules such as proteins. The development of membrane technology allows the membrane to withstand high pressure and display high hydraulic permeability. Proteins and fats which come from the carcass debris and the blood are the major 'pollutants' in the processing wastewater. They are of high nutritional value and should be recovered for refeeding. To serve this purpose, UF is a process of promise to treat the wastewater prior to discharge and to recover proteins and fats as the by-products. With a small lab-scale operation of hydraulic pressure of 20 psi, a filtration rate of 15-20 GPD/ft2 was obtained. The protein concentrations (mg/l) were 400 in the original wastewater, 50 in the filtrate, and 1,200 in the concentrate which can be dried to harvest the protein. The COD value (mg/l) dropped from 752 in the wastewater to 32 in the filtrate which may be directly discharged into the stream.(Kiger-North Carolina).
W79-04501

ASSESSMENT OF BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE FOR SYNTHETIC RUBBER MANUFACTURING WASTEWATER,
Abcor Inc., Wilmington, MA. Walden Div.
For primary bibliographic entry see Field 6B.
W79-04525

MUNICIPAL WASTEWATER AQUACULTURE,
Robert S. Kerr Environmental Research Lab., Ada, OK. Wastewater Management Branch.
W. R. Duffer, and J. E. Moyer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-284 352, Price codes: A04 in paper copy, A01 in microfiche. EPA-600/2-78-110, June 1978. 46 p, 9 tab, 71 ref.

Descriptors: *Aquiculture, *Municipal wastes, *Waste water treatment, *Reviews, *Water reuse, *Tertiary treatment, *Beneficial use, Economics, Sewage lagoons, Foods, Water pollution control, Waste water disposal, Invertebrates, Midges, Larvae, Water hyacinth, Eichhornia crassipes, Fish, Macrophytes, Path of pollutants, Wetlands, Public health, Seaweed, Algae, Organic wastes, Research priorities.

Literature of June 1977 on the developmental status of aquaculture as an alternative method for treatment and reuse of municipal wastewater was reviewed. Current technology is not adequate for designing operational aquacultural treatment systems, but several types of organisms hold considerable potential. Only new or developmental processes were considered, and conventional or advanced application processes were excluded. Systems examined included natural wetlands, artificial wetlands, macrophytes, invertebrates, fish, and integrated or food chain units. Major emphasis was given to the reduction or fate of such pollutants as organics, solids, nutrients, heavy metals, residual hydrocarbons, and potentially pathogenic organisms. Economic assessments of treatment and production rates for organisms are provided for several types of aquacultural processes, and areas having high potential for further research and development are identified. Conclusions: (1) water hyacinth, seaweed, and midge larvae show particular promise; (2) freshwater systems have a distinct advantage over marine systems as much smaller volume of water is required; (3) use of aquaculture for producing human food, which has been the major focus of research to date (with little devoted to wastewater treatment or reuse), is hampered in wastewater treatment by disease transmission and social acceptance, and other products should be investigated; (4) economic return on such products may be small, but energy savings may be realized; and (5) aquaculture may be most applicable in combination with other treatment methods. (Lynch-Wisconsin)
W79-04528

SOURCE ASSESSMENT: RAIL TANK CAR, TANK TRUCK, AND DRUM CLEANING, STATE OF THE ART,
Monsanto Research Corp., Dayton, OH.
D. E. Earley, K. M. Tackett, and T. R. Blackwood.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 726, Price codes: A04 in paper copy, A01 in microfiche. EPA-600/2-78-004g, April 1978. 56 p, 23 tab, 22 ref, 2 append. 68-02-1874.

Descriptors: *Water pollution control, *Air pollution, *Tank trucks, *Cleaning, *Tank cars, *Drums, *Environmental effects, *Water pollution sources, *Waste water treatment, Railroads, Point pollution, Air pollution effects, Water pollution effects, Transportation, Chemicals, Oil pollution, Oil, Suspended solids, Total oxygen demand, Phenol, Grease, Industrial wastes, Organic compounds, Gases.

Assessment of control methods and environmental impacts of cleaning rail tank cars, tank trucks, and drums which carry organic chemicals and petroleum products indicates that without more stringent controls air emissions will increase an estimated 30% through 1980, equal to the projected increase in chemical production. Increased wastewater treatment could reduce discharged water pollutants 50% by 1980. This report excludes gasoline, diesel and fuel oils, jet fuels, and motor oils. Carriers in dedicated service (the majority) are cleaned only prior to repair or testing. Nondedicated tank trucks and drums are cleaned after every trip to prevent cross-contamination; unit cleanings per year total 37,200 rail tank cars, five million tank trucks, and 24.7 million drums. Steaming, washing, and/or flushing cause air emissions and wastewater effluents. Air emissions from tank cars and trucks are predominately organic chemical vapors, each industry contributing less than 0.0022% of national hydrocarbon emissions. Water pollutants produced are primarily oil and grease, total effluent oxygen demand (TOD), suspended solids, and phenol. Emission control methods for tank cars and trucks include flaring, absorption, and product recovery of flushed gases. No practical control methods exist for drum washing. Emissions from drumburning furnaces are controlled by proper operating conditions. Wastewater treatment consists of a variety of physical, chemical, and biological processes. (Lynch-Wisconsin)
W79-04529

COAL HUMIC SUBSTANCES FOR THE TREATMENT OF WASTEWATER FROM STACK GAS SCRUBBERS, COAL CONVERSION PLANTS, AND OTHER COAL UTILIZATION FACILITIES,
Missouri Univ.-Columbia. Dept. of Chemistry.
S. E. Manahan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 501, Price codes: A03 in paper copy, A01 in microfiche. Missouri Water Resources Research Center, University of Missouri. Completion Report, December 27, 1978. 35 p, 8 fig, 6 tab. OWRT-A-106-MO(2). 14-34-0001-8027.

Descriptors: *Coal, *Wastewater treatment, *Humic acid, Organic compounds, Fly ash, Oil shale, Carbon-14.

Coal humic substance is a complex organic material prepared by the partial oxidation of coal. This report deals with the uses of coal humic substances for wastewater treatment. The first section is a review of humic substances and their applications to wastewater treatment. The second portion deals with laboratory studies of coal humic substances used for wastewater treatment. The removal of radiolabelled organic compounds from wastewater is described. The interaction of coal humic substances and fly ash is also discussed. Certain types of fly ash are possible sources of base for the preparation of coal humates from coal humic acid. The interaction of coal humic acid with fly ash is compared to that between fly ash and salicylic acid, a low molecular weight analog of one of the major structural entities in coal humic substances.
W79-04554

REMOVAL OF AMMONIA NITROGEN FROM WASTEWATER BY PARTIAL CHLORINA-

TION FOLLOWED BY ACTIVATED CARBON TREATMENT,
Missouri Univ.-Rolla. Dept. of Civil Engineering.
Ju-Chang Huang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 502, Price codes: A06 in paper copy, A01 in microfiche. Missouri Water Resources Reseach Center, University of Missouri Completion Report, November, 1978. 109p, 25 fig, 23 tab, 31 ref. OWRT-A-093-MO(1), 14-34-0001-7053-7054-8027.

Descriptors: *Activated carbon, *Ammonia nitrogen, Catalytic oxidation, *Chlorination, Wastewater treatment, Chloramines.

The objective was to investigate the feasibility of removing NH3-N from wastewater by first converting it to chloramines by partial chlorination and then removing the latter by activated carbon treatment. The first phase of the study was to evaluate the formation and stability of mono- and di-chloramines in aqueous solutions of different pH and different Cl2/NH3-N ratio. The second phase was to evalute the quantitative interactions between activated carbon and each species of chloramines. The relative distributions of mono-and di-chloramines were dependent mainly on pH and, to a lesser degree, on the ratio of Cl2/NH3-N. In contacting with carbon, both mono- and di-chloramines disappeared quickly. The disappearance of dichloramine was generally accomplished by catalytic oxidation of its nitrogen entity to nitrogen gas. However, the loss of monochloramine was generally accompanied by about 60% reversion of its nitrogen content to ammonia. The quantity of this reversion was not reduced by 'precharging' the activated carbon with 'surface oxides'. Thus, it is concluded that the technique using partial chlorination followed by activated carbon treatment is not very effective in removing ammonia nitrogn from wastewater.
W79-04556

PAPERMAKING PRIMARY SLUDGES. DEWATERING STUDIES REALIZED WITH DIFFERENT INDUSTRIAL DEVICES (BOUES PRIMAIRES DE PAPETERIE. ESSAIS DE DESHYDRATATION REALISES AVEC DIFFERENTS APPAREILS INDUSTRIELS),
B. Bianchin, G. Gervason, P. Vallette, and G. Sauret.
ATIP (Association Technique de l'Industrie Papetiere) Revue, Vol. 32, No. 4, p 133-147, April, 1978. 15 fig, 11 tab.

Descriptors: *Sludge treatment, *Dewatering, *Pulp and paper industry, Wastes, Industrial wastes, Water pollution sources, Solid wastes, Sludge, Equipment, Flocculation, Centrifugation, Water quality control, Pulp wastes, Presses, Belt presses, Screw presses, Filters.

Paper mill sludge dewatering tests were conducted using eight different industrial units. With the exception of the Guva filter tower, the belt presses (e.g., the Andritz-SFM 500) generally gave dewatered sludge cakes with a dryness above 40% (50% with optimum control) at a good level of retention. With the Bellmer converging-belt press, the addition of flocculating agents was necessary for good retention due to the coarseness of the wire belts. The Tasster F (a screw press) gave resuls of the same order. Interesting results were also obtained with a prototype of the Bertin dewatering press. The Westfalia and Sharpless centrifuges gave dewatered sludge dryness contents of 32-39% at retention levels above 90%. This type of device permits high operating flexibility and gives a dewatered sludge in granular rather than continuous web form. The Choquenet filter press yielded sludge at a dryness of 34-44%, but was tested only under laboratory conditions. In all cases, the devices were tested in parallel with a Philippe suction-drum filter, which yielded sludges of 29-36% dryness. (Speckhard-IPC)
W79-04581

SEWER NETWORK SCHEME FOR DIGITAL COMPUTATIONS,
Texas Univ. at Austin. Dept. of Civil Engineering.
L. W. Mays.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 104, No. EE3, Technical Note, p 535-539, June 1978. 3 fig, 4 ref, 1 append. OWRT C-4123(No.9023)(11).

Descriptors: *Network design, *Sewers, *Mathematical models, Algorithms, Computer models, Systems analysis, Sanitary engineering.

Several computer algorithms have been reported in the literature for optimal design of sewer systems, for performing hydraulic routing computations, and for various types of simulation models. A simple scheme has been developed and was presented that can be used to describe the physical arrangement of multi-level branching sewer networks for digital manipulation in computer usage. This approach for network representation uses the concepts of isonodal lines, a nodal numbering scheme, and vector of connectivity that are all generated internally in the computer from a simple and arbitrary list of node numbers. This approach has been found to be quite advantageous in both optimization models and hydraulic simulation models. The author has applied this scheme very successfully to the entire sanitary sewer network of Fort Lee, Virginia, which has over 1,000 sewer pipes. (Humphreys-ISWS)
W79-04590

ANAEROBIC DIGESTION AND MEMBRANE SEPARATION OF DOMESTIC WASTEWATER,
Thayer School of Engineering, Hanover, NH.
H. E. Grethlein.
Journal Water Pollution Control Federation, Vol. 50, No. 4, p 754-763, April, 1978. 3 fig, 4 tab, 8 ref. OWRT-A-034-NH(3), 14-31-0001-4029.

Descriptors: *Anaerobic digestion, *Membrane processes, *Septic tanks, *Reverse osmosis, *Domestic wastes, Semipermeable membranes, Filters, Biochemical oxygen demand, E. coli, Nitrates, Phosphates, Turbidity, Waste water treatment, Municipal wastes.

A domestic septic tank was converted to an aerobic digester with a variable stroke piston pump and equipped with a flat sheet semipermeable membrane module and a Helicore reverse osmosis unit operated in cyclic and continuous flow patterns. Under an on-off cyclic operating time of 2 min, a steady flux of 490 liters/sq m/day was achieved with the flat sheet membrane at a bulk velocity of 22.9 cm/sec. The membrane did not foul during cyclic operation because of the backflow when the pump was turned off. Flux during cyclic operation was maintained in the flat semipermeable membrane for 1,500 hrs and in the reserve osmosis membrane for 8,500 hrs. A bulk fluid velocity of 15.2-122 cm/sec over the membrane surface was possible, depending upon the operating cycle. The anaerobic digestion rate within the septic tank more than tripled because of higher concentrations of microorganisms and substrate; BOD was reduced by 85-95%. The system completely removed turbidity and E. coli and reduced nitrate by about 75%. The process by which insoluble phosphate was removed could not be identified. (Lisk-FIRL)
W79-04597

ELECTROCHEMICAL COAGULATION OF INDUSTRIAL EFFLUENTS (ELEKTROKHIMICHESKAYA KOAGULYATSIYA PROMYSHLENNYKH STOKOV),
Irkutskii Inst. of Organic Chemistry (USSR).
E. N. Serdobol'skii, V. A. Babkin, M. I. Anisimova, G. R. Bochkarev, and V. I. Rostovtsev.
Bumazhnaya Promyshlennost', No. 6, p 11-12, June, 1978. 1 fig, 3 tab.

Descriptors: *Bleaching wastes, *Waste water treatment, *Electrochemistry, Wastes, Industrial wastes, Water pollution treatment, Waste treatment, Water pollution sources, Pulp and paper industry, Effluents, Pulp wastes, Anodes, Aluminum, Iron, Pilot plants, Coagulation, Neutralization, Chemical oxygen demand, Color, Carbon, Phenols, Lignins, Daphnia, Toxicity, Waste dilution, Dissolving pulp, Aquatic life.

Effluents from the alkaline extraction of chlorinated dissolved pulp and a 1:1 mixture of this effluent with effluent from pulp chlorination were purified by electrochemical coagulation in pilot-plant experiments. The alkaline extraction effluent was neutralized with sulfuric acid prior to treatment. The anodes used were iron and aluminum. The pilot-plant equipment of 2.4-3 cu m/hr capacity is described and illustrated. The following reductions were achieved: COD, 82.4-91.4%; color, 94-98%; chlorolignin content, 93.8-99%; total carbon, 82.8-90.7%; and volatile phenols, 98.1-100%. Generally better results were obtained with aluminum than with iron anodes. Biological experiments conducted on Daphnia indicated a considerable reduction of effluent toxicity after purification and dilution. (Stapinski-IPC)
W79-04630

PILOT-PLANT STUDY OF TWO-STAGE CHEMICAL-BIOLOGICAL PURIFICATION OF PULPING EFFLUENTS AT THE OSTROLEKA PULP AND PAPER MILL (BADANIA POLTECHNICZNE NAD OCZYSZCZANIEM SCIEKOW CELULOZOWYCH Z OSTROLECKICH ZAKLADOW CELULOZOWO-PAPIERNICZYCH W UKLADZIE DWUSTOPNIOWYM CHEMICZNO-BIOLOGICZNYM),
Technical Univ. of Warsaw (Poland). Inst. Zaopatrzenia w Wode i Budownictwa Wodnego.
M. Apolinarski, M. Roman, Z. Ulaska, E. Skowyrski, and J. Zielinski.
Przeglad Papierniczy, Vol. 34, No. 7, p 268-272, July, 1978. 6 fig, 1 illus, 17 ref, 2 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Biological treatment, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Foreign countries, Pilot plants, Coagulation, Calcium hydroxide, Sedimentation, Carbon dioxide, Activated sludge, Biochemical oxygen demand, Chemical oxygen demand, Color, Filtration, Sludge, Dewatering, Sludge treatment, Europe, Poland, Kraft mills.

Studies of kraft pulp mill effluent purification conducted over a 3-yr period have shown that the best results are obtained by a two-stage chemical-biological treatment. Data obtained in model experiments were utilized for the design of a pilot-plant purification system at the Ostroleka (Poland) pulp and paper mill. In the model system, effluent is first treated with milk of lime, and the precipitate is allowed to settle and then saturated with carbon dioxide. Following post-saturation sedimentation, the effluent is purified by the activated sludge process. Compared to the conventional biological purification method (now operating at the Ostroleka mill), the two-stage process gave higher efficiency of purification, about 10% for 5-day BOD, 40% for COD, and 85% for color removal. The preliminary chemical treatment did not affect the activity of the activated sludge. The post-saturation sediment has the lowest filtration resistance. A mixture of sediments and excess activated sludge could be dewatered mechanically. (Stapinski-IPC)
W79-04631

APPLICATION OF REVERSE OSMOSIS AND ULTRAFILTRATION TO PURIFICATION OF PULP AND PAPER INDUSTRY EFFLUENTS. VI. PURIFICATION OF PULP BLEACHING EFFLUENTS (ZASTOSOWANIE ODWROCONEJ OSMOZY I ULTRAFILTRACJI DO OCZYSZCZANIA SCIEKOW Z PRZEMYSLU CELULOZOWO-PAPIERNICZEGO),
Instytut Inzynierii Ochrony Srodowiska Politechniki Slaskiej, Gliwice (Poland).
M. Bodzek, O. Kominek, E. Kowalska, and I. Tanistra.
Przeglad Papierniczy, Vol. 34, No. 7, p 248-251, July, 1978. 12 ref, 5 tab. English summary.

Descriptors: *Bleaching wastes, *Waste water treatment, *Reverse osmosis, Pulp wastes, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Membrane processes, Cellulose, Membranes, Separation techniques, Chemical oxygen demand, Color, Chlorides, Conductivity, Ultrafiltration, Temperature, Filters.

Effluents from each stage of a bleaching sequence for sulfite pulp (CEHH) and for kraft pulp (CEHD) were subjected to ultrafiltration (UF) and reverse osmosis (RO) through cellulose acetate membranes. The effectivenss of the two processes was evaluated by determinations of the mean filtration rate and the reduction of pollution load. UF gave reductions in color up to 95%, in average COD of 70%, and in oxidizability of 80%. The reduction in content of soluble substances did not exceed 50%, and the reductions in chloride content and conductivity were low (10-20% and 18-35%, respectively). The effectiveness of RO depended on the temperature of the membrane treatment; the best results were obtained at 80C. Such membranes attained over 80% reduction of all pollution indicators. Clogging of cellulose acetate membrane pores did occur, causing a reduction of the filtration rate, accompanied by a higher average degree of purification. Although purification was lower than in the case of pulp washing effluents, the use of UF and RO appears promising. (Stapinski-IPC)
W79-04632

CRITERIA FOR SELECTING INSTALLATIONS FOR FIBER RECOVERY (AUSWAHLKRITERIEN FUER ANLAGEN ZUR FASERRUECKGEWINNUNG),
Voith (J. M.) G.m.b.H., Heidenheim (Germany, F.R.).
J. Velinsky.
Wochenblatt fuer Papierfabrikation, Vol. 106, No. 14, p 533-536, 538, July 31, 1978. 2 fig, 6 ref.

Descriptors: *Pulp wastes, *Fiber recovery, *Waste water treatment, Wastes, Industrial wastes, Water pollution treatment, Waste treatment, Water pollution sources, Pulp and paper industry, Effluents, Sedimentation, Filtration, Flotation, White water(Paper machines), Closed systems, Water conservation, Industrial water.

Fiber recovery from paper machine white water or paper mill effluent can also be called water clarification, depending on where the emphasis lies in a particular system. The three processes in common use are described and discussed, namely, sedimentation, filtration, and flotation. The advantage and disadvantages of each are compared, and the suitability of each for various types of operation is indicated. The effect closing the paper-machine water circuit is briefly discussed. (Ward-IPC)
W79-04633

REMOVAL OF COLOR FROM CARBONATE PULPING EFFLUENT – THE CALCIUM-MAGNESIUM COAGULATION PROCESS,
Institute of Paper Chemistry, Appleton, WI.
S. G. Lathis, and T. W. Joyce.
Tappi, Vol. 61, No. 10, p 67-70, October, 1978. 4 fig, 11 ref, 4 tab.

Descriptors: *Pulp wastes, *Decoloring, *Coagulation, *Waste water treatment, Wastes, Industrial wastes, Water pollution sources, Water pollution treatment, Pulp and paper industry, Effluents, Color, Calcium compounds, Magnesium compounds, Waste treatment, Hydrogen ion concentration, Sludge, Chemical precipitation, Spent pulping liquors, Carbonate pulping, NSSC(Neutral Sulfite Semichemical) pulping.

The influence of the trend to replace neutral sulfite semichemical (NSSC) pulping with carbonate pulping on the Ca-Mg coagulation process for effluent color removal was studied at the Institute of Paper Chemistry (Appleton, Wis.). Good color removal from spent carbonate pulping liquor can be obtained by using 300 ppm Ca at pH 12. Comparisons of IR spectra of carbonate and NSSC effluents indicated that carbonate effluent contains insignificant amounts of lignosulfate and carboxylic acid groups. The presence of lignosulfate is undesirable in color removal because it forms a partially soluble salt with bivalent metals. The color removal mechanism is best understood by considering the reaction of Ca-Mg with an acidic functional group (e.g., carboxyl, keto-enolic, and phenolic hydroxyl groups) in the organic compounds in spent pulping liquors. Magnesium is not required in the color removal process for carbonate effluents, since it reacts primarily with carboxylic acid groups. The color removal process is reversible and highly dependent on pH. Reducing pH to about 7.6 will redissolve the sludge, and the effluent will regain its original color. (Switchtenberg-IPC)
W79-04635

TOXICITY REMOVAL BY PRIMARY TREATMENT (OF KRAFT PULP MILL EFFLUENT),
Institute of Paper Chemistry, Appleton, WI.
E. T. Muehlethaler.
In: Proceedings of the Institute of Paper Chemistry (Appleton, Wisconsin) 42nd Executives Conference, May 10-11, 1978. p 32-33.

Descriptors: *Pulp wastes, *Waste water treatment, *Detoxification, Wastes, Industrial wastes, Water pollution treatment, Water pollution sources, Waste treatment, Pulp and paper industry, Effluents, Bioassay, Chemical precipitation, Flotation, Toxicity, Fish, Aquatic animals, Aluminum sulfate.

Laboratory bioassays conducted at the Institute of Paper Chemistry (Appleton, Wisconsin) investigated the comparative effectiveness of two effluent primary treatment methods, viz., solids precipitation with alum vs. flotation with dissolved air, in reducing the fish toxicity of untreated kraft pulp mill effluent in terms median survival time (MST) at which 50% of test organisms are still alive in tanks containing a given effluent concentration. For the particular effluent used, neither of the two treatment processes was better than the other. At the concentrations used (20%), untreated effluent gave MST values of 7.5-8.0 hr, compared to 31.5-46.5 hr for effluent after dissolved-air flotation. (Brown-IPC)
W79-04637

ADVANCED STEPS TOWARDS THE POLLUTION-FREE BLEACHED SULFITE MILL,
IVL-Consulting Ltd., Goteborg (Sweden).
For primary bibliographic entry see Field 3C.
W79-04639

EXTRACTING LIGNINS FROM MILL WASTES,
National Aeronautics and Space Administration, Pasadena, CA. Jet Propulsion Lab.
M. F. Humphrey.
Southern Pulp and Paper Manufacturer, Vol. 41, No. 9, p 27-28, September, 1978. 1 fig, 1 tab.

Descriptors: *Pulp wastes, *Lignins, *Separation techniques, *Waste water treatment, Wastes, Industrial wastes, Pulp and paper industry, Effluents, Water pollution treatment, Water pollution sources, Ammonium compounds, Chemical precipitation, Activated carbon, Sludge, Sludge treatment, Filtration, Hydrogen ion concentration, Distillation, Recycling, Quaternary ammonium compounds.

Quaternary ammonium compounds are used to precipitate lignins and colored lignin degradation products from pulp and paper mill effluents, and activated carbon is used to absorb other contaminants to obtain purified and reusable water. The sludge is filtered, and the cake is transferred to a dissolving tank where methanol is added to dissolve the quaternary ammonium derivatives of lignin. The slurry is filtered to remove the solids which are pyrolyzed to produce activated carbon, while the solution if fed to a lignin precipitation tank. When the methanolic solution is acidified, quaternary ammonium compounds become soluble and lignins insoluble; therefore a mineral acid such as sulfuric, hydrochloric, or phosphoric acid is used to adjust the pH to 2-2.5. The resultant slurry is filtered to remove the lignin solids, while the methanol is recovered by distillation. The remaining quaternary ammonium salts are adjusted to pH 5-8 and recycled. (Louden-IPC)
W79-04640

FILTER BELTS VS. PRESSURE IN DEWATERING OF SLUDGES,
National Council of the Paper Industry for Air and Stream Improvement, Inc., Kalamazoo, MI.
D. W. Marshall.
Southern Pulp and Paper Manufacturer, Vol. 41, No. 9, p 23-26, September, 1978. 2 tab.

Descriptors: *Sludge treatment, *Dewatering, *Pulp and paper industry, Pulp wastes, Wastes, Waste treatment, Solid wastes, Operation and maintenance, Filtration, Sludge, Electric power, Screens, Equipment.

Filter-belt presses are usually used to dewater pulp and paper mill sludges that are difficult to filter or centrifuge. These presses require more sludge conditioning than do some other processes. Power requirements and cake consistencies are good. Performance figures are cited. Operating problems are largely associated with start-up and refinement of machinery; the more common difficulties include bearing failures, belt tracking problems, and occasional belt tearing. Inclusion of a screening device might be useful to remove large pieces of debris from the feed. Pressure filtration is the most commonly used alternative. Precoat utilization is not always necessary. Startup problems with pressure filters can be substantial; the more common difficulties include plate warping or breakage, media tearing, poor sludge and/or precoat distribution within the chambers, and malfunction with timing and plate shifting devices. Pilot and full-scale data are given for both types of equipment. (Louden-IPC)
W79-04641

REAGENT-FREE METHOD OF EFFLUENT NEUTRALIZATION (BEZREAGENTNYI SPOSOB NEITRALIZATSII STOCHNYKH VOD),
Vsesoyuznyi-Nauchnyi Planovii Otdel Bumazhnoi Promyshlennost, Moscow (USSR).
V. P. Semenov, V. V. Popov, and V. V. Gulyaev.
Bumazhnaya Promyshlennost', No. 6, p 4-5, June, 1978. 2 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Neutralization, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Aluminum, Sulfates, Lime, Hydrogen ion concentration, Carbon dioxide, Sedimentation, Alkalis(Bases), Aeration, Costs, Water pollution control, Sodium hydroxide.

The neutralization of kraft mill effluents following their chemical purification with aluminum sulfate is usually done with NaOH or lime. It has been observed that the pH increases after sedimentation of the treated effluent. The concentration of free carbon dioxide increases during chemical purification, and during sedimentation of the purified effluent the carbon dioxide is released into the atmosphere and the pH increases. The process is slow, however, and the pH may not reach the necessary level of 6.8. A method is proposed for accelerating this process and at the same time avoiding the use of alkali for neutralization of the chemically purified effluent. The method involves aerating the treated effluent for about 10 min to drive off the excess carbon dioxide. The initial pH of the chemically treated effluent should not be lower than 5.4-5.5 to obtain a final pH of 6.8. The method reduces the cost of purification and the mineral content of the effluents, due to the elimination of the alkaline neutralization reagents. (Stapinski-IPC)
W79-04642

MECHANISM OF ALUMINUM SULFATE RECOVERY FROM LIGNIN SLUDGE (MEKHANISM IZVLECHENIYA SULFAT ALYUMINIYA IZ SHLAM-LIGNINA),
Vsesoyuznyi-Nauchnyi Planovii Otdel Bumazhnoi Promyshlennost, Moscow (USSR).
M. B. Berov, and V. M. Shapchenko.
Bumazhnaya Promyshlennost', No. 6, p. 13-14, June, 1978. 3 fig.

Descriptors: *Pulp wastes, *Lignins, *Aluminum sulfate, *Sludge, *Chemical recovery, Wastes, Industrial wastes, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Costs, Hydrogen ion concentration, Cations, Waste treatment, Solid wastes, Separation techniques, Coagulation sulfur compounds, Kraft mills.

The high cost of aluminum sulfate prevents its widespread use in the chemical purification of pulp and paper industry waste waters. Recovery and reuse of this coagulant would help reduce overall consumption. Recovery of aluminum sulfate is possible with the development of a method of dewatering lignin sludge obtained in chemical purification of kraft mill effluents. The relation between the degree of aluminum recovery and the pH and time of the reaction and the amount of sulfuric acid was studied. A mechanism is proposed for the aluminum recovery process. The sludge formed during treatment of the effluent consists of a lignin-aluminum adduct and aluminum sulfate hydrolysis products. During the recovery process, the acid reacts with both these components, yielding aluminum cations and polycations of the adduct. The solubilization of the adduct polycations is due to replacement of aluminum by the acid protons. There is no complete solubilization, however, because of the formaton of intermolecular H-bonds and the low solubility of lignin in acidic media. The amount of polycations in the recovered reagent depends on the pH and is maximum at pH 2.5-2.7. (Stapinski-IPC)
W79-04643

DEWATERING OF HIGH-ASH SEDIMENTS OF EFFLUENTS (OBEZVOZHIVAMIE VYSOKOZOLINYKH OSADKOV STOCHNYKH VOD),
Vsesoyuznyi-Nauchnyi Planovii Otdel Bumazhnoi Promyshlennost, Moscow (USSR).
A. I. Volkov, Yu. I. Chernousov, M. L. Murskaya, S. S. Bykova, and A.-V. S. Mil'vidas.
Bumazhnaya Promyshlennost', No. 6, p. 5-6, June, 1978. 3 fig.

Descriptors: *Dewatering, *Sludge treatment, *Pulp and paper industry, Wastes, Industrial wastes, Water pollution sources, Water pollution treatment, Foreign countries, Centrifugation, Sludge, Solid wastes, Waste treatment, Soviet Union (USSR), Board mills, Polyacrylamide, Aluminum sulfate, Effluents.

The increasing application of centrifugation for dewatering effluent sludge is due to the higher efficiency of this method compared to dewatering by vacuum or pressure filtration. To determine the optimum parameters of centrifugal dewatering, experiments were conducted at the Klaipeda pulp and board mill (USSR) with the OGSh-321 K-5 centrifuge and sedimentation pond sludge containing up to 80% ash. Bark, chips, and other large particles were removed from the sludge, and the sludge was centrifuged directly or after the addition of varying amounts of polyacrylamide and/or aluminum sulfate. The recommened load for dewatering the Klaipeda mill sludge is 3.5-4 cu m/hr at an initial concentration of 30-38.2 g/liter and solid-phase ash contents of 33-48.7%. The addition of polyacrylamide had little effect on the process variables, while the addition of aluminum sulfate in some cases lowered the efficiency of the centrifuge. (Stapinski-IPC)
W79-04644

DYNAMICS OF EFFLUENT CLARIFICATION (DINAMIKA OSVETLENIYA STOCHNYKH-VOD),
Vsesoyuznyi-Nauchnyi Planovii Otdel Bumazhnoi Promyshlennost, Moscow (USSR).
G. P. Kuchin, E. M. Bakaeva, I. A. Evstigneev, and L. A. Makarova.
Bumazhnaya Promyshlennost', No. 6, p 8-9, June, 1978. 2 fig.

Descriptors: *Pulp wastes, *Sedimentation, Waste water treatment, Wastes, Industrial wastes, Water pollution sources, Pulp and paper industry, Effluents, Suspended solids, Particle size, Fluid mechanics, Hydraulic properties, Hydrodynamics.

Effluents from the manufacture of several types of paper were placed in one-liter cylinders and left undisturbed for 5-120 min. Experimental curves showing the clarification effect as a function of the hydraulic coarseness of particles (i.e., ratio of the water column height to sedimentation, mm/sec) and of the sedimentation rate reveal that at the same hydraulic coarseness of suspended particles, the clarification effect is different for different types of effluents. This indicates different agglomeration capacities of the solids. Most kinetic curves of clarification show two zones, a zone of rapid sedimentation (about 30 min) and a zone of slow sedimentation. There was no initial rapid sedimentation phase for some types of effluents. The degree of final clarification also depended on the type of effluent. It was 100% for effluents from the manufacture of fillerless papers, lower for filled papers, and only 50% for effluent from groundwood-containing papers. (Stapinski-IPC)
W79-04645

UTILIZATION OF EVAPORATOR CONDENSATES AS A REPLACEMENT FOR FRESH WATER (ISPOL'ZOVANIE KONDENSATOR VYPARNOGO TSEKHA VZAMEN SVEZHEI VODY),
Sibirskii Nauchno-Issledovatelskii Inst. Tsellyulozy i Kartona (USSR).
G. E. Danilov, V. R. Namsaraeva, A. Kh. Namsaraeva, M. I. Babchuk, and A. G. Berdyshev.
Bumazhnaya Promyshlennost', No. 6, p 24-25, June, 1978. 1 fig, 2 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Condensates, *Water reuse, Wastes, Industrial wastes, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Foreign countries, Odor, Lime, Evaporators, Water pollution control, Recycling, Soviet Union(USSR), Pulp washing, Industrial water, Water conservation.

Evaporator condensates from the Selenga (USSR) pulp and paper mill were analyzed for their degree of pollution. The analyses showed that condensates from effects (plates)2, 3, and 4 are the least polluted. Condensates from effects 5 and 6 have a high concentration of pollutants and a strong odor, and cannot be recommended for reuse. A system was developed for feeding condensates from effects 2, 3, and 4 into the hot water tank to be used for washing of pulp and of causticization mud. The more polluted condensates are deordorized and discharged. However, it is planned to use these condensates in the future for washing causticization mud and for recovery of lime. The use of condensates does not affect the quality of the pulp and significantly lowers the load of the purification equipment. (Stapinski-IPC)
W79-04646

RESEARCH ON PULP AND PAPER INDUSTRY WATER AND EFFLUENT QUALITY PROBLEMS -- A REVIEW,
British Columbia Research Council, Vancouver.
For primary bibliographic entry see Field 5C.
W79-04668

PREDICTIVE MODEL FOR DESIGN OF FIXED-BED ADSORBERS: PARAMETER ESTIMATION AND MODEL DEVELOPMENT,
Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.
J. C. Crittenden, and W. J. Weber, Jr.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. EE2, p. 185-197, April 1978. 5 fig, 1 tab, 34 equ. 14 ref.

Descriptors: *Model studies, *Adsorption, *Diffusion, *Waste water treatment, *Fixed-bed models, *Kinetics, Mass transfer, Numerical analysis, Isotherms, Parameters, Design, Programs, Evaluation, Effects, Methodology, Prediction, Systems analysis, Equations.

A predictive mathematical model for fixed-bed adsorber design which incorporates both liquid and solid phase resistances to mass transfer is formulated: numeric solutions are described and checked for accuracy. Laboratory bench scale studies used to estimate model parameters independently from adsorber break-through profiles are described, and experimental results are presented. The bench scale tests involve both adsorption rate and isotherm measurements that are used to determine isotherm equation parameters and surface diffusion coefficients for model calibration. Liquid-phase mass transfer coefficients for fixed-bed operation are obtained from literature correlations; parameter values used for model calibration are presented. This paper sets the stage for single- and multi-component model verifications to be presented in two subsequent papers. (Bell-Graf--Cornell)
W79-04704

EVALUATION OF EPA RECOMMENDED TREATMENT AND CONTROL TECHNOLOGY FOR BLAST FURNACE WASTEWATER,
Carnegie-Mellon Inst. of Research, Pittsburgh, PA.
G. M. Wong-Chong, and S. C. Caruso.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. EE2, p. 305-321, April 1978. 45 fig, 5 tab, 17 ref.

Descriptors: *Waste water treatment, *Water reuse, *Chlorination, *Mass transfer, *pH control, *Phenols, *Gas-liquid ratio, *Gas scrubbing, *Blast furnaces, Suspended solids, Technology, Assessment, Ammonia, Alkalinity, Cyanides, Effluents, Sedimentation.

The EPA-recommended technology for treating blast furnace wastewater--essentially suspended solids removal and recirculation--was evaluated and found to be inadequate to produce effluent quality in total compliance with the 1977 limitations that include ammonia, cyanide, and phenol. Alkaline chlorination and gas-liquid mass transfer were examined for controlling the ammonia, cyanide, and phenol. The EPA-ELG was developed from a very limited data base. This evaluation examined an extensive data base consisting of responses to a questionnaire, long-term plant operating data, field survey, and literature review. (Bell-Graf--Cornell)
W79-04705

ENERGY FOR PRODUCTION OF CONSUMABLE MATERIALS,
Culp/Wesner/Culp, Santa Ana, CA.
G. M. Wesner.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. EE3, p 401-414, June 1978. 3 tab, 14 ref.

Descriptors: *Waste water treatment, *Water treatment, *Energy, *Energy consumption, *Chemicals, Environmental engineering, Manufacturing, Chemical plants, Consumers, Equations.

Energy requirements were determined for the production of the following consumable materials used in various water and wastewater treatment operations: activated carbon, alum, ammonium hydroxide, carbon dioxide, chlorine, ferric chloride, calcium oxide, methanol, oxygen, ozone, polymers, sodium chloride, sodium hydroxide, sulfur dioxide, and sulfuric acid. Energy estimates are based on data from manufacturers, information in the technical literature and calculations. Data used in developing the energy estimates are discussed. Precise

energy requirements are difficult to determine for some materials because some manufacturing processes produce more than one product, and most chemicals are produced by more than one method. (Bell-Graff--Cornell)
W79-04713

INVESTIGATION OF THE REMOVAL OF TRACE TOXIC HEAVY METAL IONS FROM WASTE WATER BY FOAM FRACTIONATION,
Polytechnic Inst. of New York, Brooklyn. Dept. of Chemistry.
Y. Okamoto, and E. J. Chou.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 706, Price codes: A04 in paper copy, A01 in microfiche. Final Report OWRT/S--78/7, April 1978. 60 p. Also in: Separ. Sci. 741(1975); Separ. Sci. 99(1976); J. Water Poll. Cont. 2447(1976); and Separ. Sci. 439(1978). OWRT 14-30-3299.

Descriptors: *Foam separation, *Foam fractionation, *Surfactants, *Waste water treatment, *Chelation, Copper, *Heavy metals, *Trace elements, Metabolic ions, Surface tension, Chelating constant, *Separation coefficient.

The experimental work on the removal of a trace amount of metallic ions such as beryllium, cadmium, lead, mercury, copper and nickel from aqueous solution by a foam separation technique using chelating surfactants was investigated. Surfactants containing polyamine such as 4-dodecyldiethylene triamine were used as selective chelate surfactants. These ions could be removed quantitatively using a selected surfactant. These surfactants chelated with metallic ions which were found to be concentrated in the foam. The foam was removed from the liquid, and the surfactant was regenerated and recycled by the decomposition of the surfactant-metal ion complexes with Na2S and H2S. Those metal ions were precipitated as the metal sulfides and the regenerated surfactant was recycled. To establish the feasibility of using foam separation for the separation of a particular ion from one or more ions having similar charge, a selectivity coefficient was determined. The selectivity coefficient was found to be a function of surface tension of complexes and chelation constant of chelating surfactant with metallic ion.
W79-04754

CONSTRUCTION COSTS FOR MUNICIPAL WASTEWATER CONVEYANCE SYSTEMS: 1973-1977.
Dames and Moore, Denver, CO.
For primary bibliographic entry see Field 6B.
W79-04761

AMMONIA TOXICITY AND PH CONTROL IN FISH TOXICITY BIOASSAYS OF TREATED WASTEWATERS,
Los Angeles County Sanitation Districts, Whittier, CA. San Jose Creek Water Quality Lab.
For primary bibliographic entry see Field 5C.
W79-04817

LAKE NEMATODE POPULATION INCREASE FOLLOWING BYPASS OF SECONDARY EFFLUENT,
Cornell Univ. Ithaca, NY. Dept. of Natural Resources.
For primary bibliographic entry see Field 5C.
W79-04818

ANNUAL CYCLES OF SOME CLADOCERANS IN A POLLUTED STREAM,
Baghdad Univ. (Iraq). Dept. of Biology.
For primary bibliographic entry see Field 5C.
W79-04820

CYCLOMORPHOSIS IN DAPHNIA CARINATA KING (CRUSTACEA: CLADOCERA) FROM TWO ADJACENT SEWAGE LAGOONS IN SOUTH AUSTRALIA,
Adelaide Univ. (Australia). Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W79-04821

ACCUMULATION OF HEAVY METALS BY THE MARINE DIATOM DITYLUM BRIGHTWELLII (WEST) GRUNOW,
Melbourne Univ., Parkville (Australia). School of Botany.
For primary bibliographic entry see Field 5C.
W79-04822

BIOLOGICAL CONTROL OF DISSOLVED ALUMINUM IN SEAWATER: EXPERIMENTAL EVIDENCE,
Northwestern Univ., Evanston, IL. Dept. of Geological Sciences.
M. Stoffyn.
Science, Vol. 203, p 651-653, 1979. 2 fig, 13 ref.

Descriptors: *Aluminum, *Diatoms, *Growth rates, Marine algae, Water chemistry, Chemical analysis, Sea water, Metals, Cytological studies, Metabolism, Adsorption, Phytoplanton, *Skeletonema.

Experimental evidence supports the hypothesis that the concentration and distribution of dissolved aluminum in ocean water are controlled by biological activity in the surface waters. The growth of the diatom Skeletonema costatum in artificial seawater media spiked with aluminum reduced the aluminum concentration to that actually found in surface open ocean waters (about 0.5 micrograms per liter). Furthermore, aluminum had a catalytic and limiting effect on the growth of the diatoms. (Deal-EIS)
W79-04824

UPGRADING FACULATIVE WASTEWATER LAGOONS WITH VASCULAR AQUATIC PLANTS,
National Space Technology Labs., NSTL Station, MS.
B. C. Wolverton, and R. C. McDonald.
Journal of the Water Pollution Control Federation, Vol. 51, p. 305-313, 1979. 2 fig, 5 tab, 24 ref.

Descriptors: *Wastewater treatment, *Sewage lagoons, Plant populations, *Aquatic plants, Sewage treatment, Water hyacinth, Biochemical oxygen demand, Algae, Nitrogen, Domestic wastes, Phosphorus, Nutrients, Seasonal, Dissolved oxygen, Mosquitoes, *Duckweed, *Gambusia.

The performance of a single-cell, facultative wastewater lagoon has been significantly improved with the introduction of vascular aquatic plants. Water hyacinth (Eichbornia crassipes) was the dominant plant from April to November; duckweek (Lemna and Spirodela spp.) flourished from December to March. This 2-ha lagoon received approximately 475 m3/d of untreated wastewater and had a 5-day biochemical oxygen demand loading rate of 22 to 30 kg/ha.d. During the first 14 months of operation with aquatic plants, the average influent 5-day biochemical oxygen demand was reduced by 95% from 110 mg/l to an average of 5 mg/l in the effluent. The average influent suspended solids were reduced by 90% from 97 mg/l to 10 mg/l in the effluent. (Deal-EIS)
W79-04830

FUNDAMENTAL RESEARCH NEEDS FOR WATER AND WASTEWATER TREATMENT SYSTEMS,
Proceedings of a conference held at Arlington, VA, December 15, 1977 sponsored by the National Science Foundation and organized by the Association of Environmental Engineering Professors, J. H. Sherrard, Editor 111 p.

Descriptors: *Wastewater treatment, *Municipal wastes, *Water pollution, Effluents, *Sludge treatment, *Sludge disposal, *Research priorities, *Research needs, Water resources, Water resources development, Planning, Environmental engineering, Water treatment, Chemical treatment.

This report is a compilation of papers presented at a conference of which the primary objectives were (1) to provide a forum and focal point for the exchange of information on fundmental research needs between the academic community, users of research, and granting agencies; (2) to define and establish priorities for these research needs; and (3) to disseminate the conference proceedings for the purpose of stimulating research in high priority areas. The conference addressed fundamental research needs which have been ignored by government funding sources in their effort to construct wastewater treatment plants. Major research topics include: fundamental research needs as seen by the user of research; congressional perspective on research needs; fundamental research needs in wastewater treatment; fundamental research needs for evaluating the interactions of treatment plants with aqueous systems; and fundamental research needs for evaluating the interactions of treatment plants with ultimate sludge disposal systems. After presentation of papers in each area, a short summary of discussion comments by other participants in the Conference is offered. (Coan--NC)
W79-04852

PURIFYING OIL SHALE RETORT WATER,
University of Southern California, Los Angeles. (Assignee).
T. F. Yen, and J. E. Findley.
U.S. Patent No. 4,124,501, 6 p, 1 fig, 1 tab, 16 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 1, p 236, November 7, 1978.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Water quality control, Oil shales, Anaerobic bacteria, Sulfur bacteria, Flocculation, Industrial water, Sulfide, Sulfates, Aerobic bacteria.

A major waste product from oil shale retorting processes is water co-produced with the shale oil and which can also include a small amount of water originally trapped within the matrix of the oil shale. Although water is produced as a result of retorting of the oil shale, in the production of oil from oil shale, a great deal of water is in fact used. It would therefore be desirable to be able to utilize water formed from retorting for these production processes. However, the oil shale retort water is loaded with considerable quantities of soluble organic and inorganic materials not only preventing its utilization for production purposes, but also presenting a serious major disposable problem. This invention provides a process for purifying the oil shale retort water which has organic and inorganic components including sulfate, to enable the growth of anaerobic bacteria. Such bacteria, exemplified by the Desulfovibrio family, is added to the retort water so as to produce in the water a growth of cell biomass of the bacteria while simultaneously reducing sulfate ions to sulfide. Production of cell biomass should proceed substantially in the absence of air, preferably following purging with carbon dioxide, nitrogen to establish aerobiasis. The cell biomass is aggregated into a flocculuent mass and is removed. The sulfide is oxidized to sulfate either through combustion processes or by conversion with air and aerobic bacteria, such as of the Thiobacillus family. At least a portion of the sulfate thus produced can be recycled to the retort water so as to neutralize it prior to bacterial growth. The effluent discharge yields a water quality which not only reduces environmental damage, but also supplements industrial water requirements. (Sinha-OEIS)
W79-04883

SEWAGE TREATMENT SYSTEM,
FMC Corp., San Jose, CA. (Assignee).
M. F. Hobbs, and A. C. Green.
U.S. Patent No. 4,124,499, 11 p, 6 fig, 20 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 1, p 235-236, November 7, 1978.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Water pollution control, Chemicals, Ships, Suspended solids.

A method is provided for rapidly producing a treated waste mixture separable into a disposable mass of solids and a hygenic effluent of relatively low coliform count. The method of treating aqueous mediums involves steps in which a mixture of aqueous medium and four chemical additives, plus, if desired, a pH control agent, are established as a mixture in a holding zone. The solids of the mixture have a particle size resulting from recirculation between the holding zone and a zone adapted to effect coarse disintegration of any solids exceeding a predetermined size. The mixture is passed through an airtight liquid flow system under conditions to maintain solids in suspension and then separating the liquid portion from the solids for disposal as a hygenic effluent. The additives are a bactericidal agent, a colloidal solids coagulating agent, a filter aid and an adsorbent. (Sinha-OEIS)
W79-04886

APPARATUS FOR TREATING SEWAGE,
J. L. Ramer.
U.S. Patent No. 4,124,481, 5 p, 2 fig, 12 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 1, p 230, November 7, 1978.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Water pollution treatment, Aerobic conditions, Electrolysis, Anodes, Cathodes, Mixing, Aerobic bacteria, Equipment.

There is provided a method and apparatus for treating sewage, by first comminuting raw sewage in a comminuting compartment to provide a slurry and then digesting the raw, comminuted sewage by oxygen-dependent bacteria in a roofed compartment. Oxygen is supplied by electrolysis of the water in the sewage, utilizing spaced anode and cathode. The anode is located in the roofed digestion compartment, and the oxygen generated at the anode is used by the bacteria; the cathode is located in a chimney which extends through the roof or top of the plant, to atmosphere, and the hydrogen generated at the cathode is discharged to atmosphere through this chimney. A stirrer is provided in the digestion compartment to stir trapped oxygen back into the mass of sludge. A trapping or sedimentation compartment is provided after the digestion compartment, for settling out indigestible solids, and drawing off the remaining liquid. (Sinha-OEIS)
W79-04888

PROCESS FOR TREATING CAUSTIC WASH SOLUTIONS,
G. Munden.
U.S. Patent No. 4,124,504, 5 p, 4 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 1, p 237, November 7, 1978.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Water pollution control, *Water reuse, Chemical reactions, Flocculation, Chemical precipitation, *Caustic wash solutions, Regeneration, Permanganate ions.

A process is provided for an effective means to remove contaminants from a caustic wash solution used in cleaning metal articles. The contaminants can be classified into three broad categories, e.g. saturates, olefins, and aromatics which represent about 25 to 30% by weight of the total contamination. The caustic wash solutions are regenerated in an efficient, relatively inexpensive manner by means of chemical purification using permanganate ions. It appears that the permanganate oxidizes the organic contaminants of the wash solution by generally attacking at a double bond junction. This then effects reduction of the organic compounds to tar residues which tend to adhere onto the surface of the manganese dioxide and improve the flocing efficiency. Another characteristic of precipitation of the manganese dioxide is that it initiates coprecipitation. After separation of the flocs, the solution is suitable to be reused as a wash solution thus eliminating disposal problems and adverse ecological and environmental effects. (Sinha-OEIS)
W79-04889

PROCESS FOR THE PURIFICATION OF GREASY AND SOILED WATER USING A HEAVY SOLVENT, AND APPARATUS FOR ITS IMPLEMENTATION,
Peignage Amedee, Roubaix (France). (Assignee).
B. J. O. Leman.
U.S. Patent No. 4,124,502, 7 p, 2 fig, 16 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 1, p 236, November 7, 1978.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Organic wastes, Solvents, Solvent extraction, Separation techniques, Recycling, Distillation, Equipment, Wool industry, Grease.

A process for the purification of waste water containing grease and soil, especially the effluent from wool-soaking and wool-washing, comprises mixing the waste water with a heavy solvent. The emulsion formed obtains degreased water, a small quantity of water-solvent emulsion, and solvent charged with greasy matter and soil. This solvent is clarified to separate the soil and is subjected to an azeotropic distillation in the presence of water to form an emulsion from which the greasy matter can be recovered, and a head product from which the solvent can be regenerated. (Sinha-OEIS)
W79-04890

DEGRADATION OF ORGANIC COMPOUNDS IN EFFLUENTS BY WET OXIDATION,
Farbenfabriken Bayer A.G., Leverkusen (Germany, F.R.). (Assignee).
O. Horak, H. Alles, W. Hortmann, K. Hammerstrom, and R. Potthast.
U.S. Patent No. 4,124,505, 4 p, 1 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 1, p 237, November 7, 1978.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Organic wastes, Water pollution treatment, Oxidation, Oxygen-reduction potential, Electrolysis.

The object is to obviate the disadvantages attending the conventional wet oxidation process and in particular to enable wet oxidation of the organic substances present in the effluent to be carried out at lower temperatures and pressures. The oxidation is effected at a recos potential of from about 300 to 600 millivolts, as measured with a platinum electrode against a silver-silver chloride electrode, at a temperature of from about 80 to 250C and under a pressure of from about 30 to 200 bars. The redox potential may be maintained by an Fe2+ and/or Fe3+ ion system and the pH is advantageously below about 7. (Sinha-OEIS)
W79-04892

APPARATUS AND METHOD FOR TREATING WASTE-CONTAINING LIQUORS,
Research Corp., New York. (Assignee).
H. Hagiwara.
U.S. Patent No. 4,126,545, 8 p, 5 fig, 11 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 3, p 935-936, November 21, 1978.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Organic wastes, Biological treatment, Bacteria, Filtration, Equipment.

Waste containing liquor is treated in a device containing submerged, slowly rotating bacterial growth surfaces which are spaced apart from each other, extend in a horizontal plane and are mounted on a vertical, rotating shaft. The bacterial growth surfaces, which may be in the configuration of a substantially flat disk, are maintained submerged in a waste water treatment tank as the waste-containing liquor is passed over, through and around them. The tank may be provided with several sets of growth areas and shafts which are interleafed and separated from each other. (Sinha-OEIS)
W79-04893

PROCESS AND APPARATUS FOR REMOVING IMPURITIES DISSOLVED IN WATER,
Nat. Ulrich Baensch G.m.b.H., Melle (Germany, F.R.). Tetra Werke. (Assignee).
U. Baensch, and L. Benedetto-Castro.
U.S. Patent No. 4,126,544, 9 p, 7 fig, 16 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 3, p 935, November 21, 1978.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Water purification, Biological treatment, Nitrates, Nitrogen compounds, Ammonia, Anaerobic conditions, Nitrification, Equipment.

A process and apparatus is described for removing impurities dissolved in water such as organic nitrogen compounds, nitrates, nitrites and ammonium compounds. Biological processes are utilized comprising the steps of passing the water to be purified in the presence of a normal atmosphere, is downwardly flowing manner through a system which ensures ammonification and nitrification. Then the water is passed, in the presence of a nitrogen atmosphere, through a system which physically expels oxygen, then passing the water once again in the presence of a nitrogen atmosphere through a system which biologically reduces nitrates, and finally after draining off the gases formed from the impurities, removing purified water. (Sinha-OEIS)
W79-04894

ION EXCHANGE PROCESS,
Asahi Kasei Kogyo Kabushiki Kaisha, Osaka (Japan). (Assignee).
T. Misumi, T. Miyaji, and M. Kasai.
U.S. Patent No. 4,126,548, 6 p, 6 fig, 2 tab, 9 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 3, p 936-937, November 21, 1978.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial wastes, Ion exchange, Resins, Adsorption, Equipment, Regeneration, Backwashing.

A countercurrent fixed-bed ion exchange process for treatment of a fluid comprises passing a fluid to be treated through a treatment zone packed with ion exchange resin particles in one direction, regenerating the ion exchange resin particles on depletion in activity by passing a solution of regenerant in opposite direction and subjecting the contaminated ion exchange resin particles to a backwash treatment in a backwashing zone which is provided separately from the treatment zone. The backwash treatment is conducted by removing portionwise, either continuously or intermittently, the contaminated resins from an outlet provided at one side of the treatment zone, and transporting them to the backwashing zone. They are then returned portionwise, either continuously or intermittently, to the treatment zone through an inlet provided at the opposite side until the while ion exchange resins particles are replaced.(Sinha-OEIS)
W79-04895

FLASH REACTOR,
C. Doerschiag.
U.S. Patent No. 4,126,550, 5 p, 3 fig, 8 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 3, p 937, November 21, 1978.

Descriptors: *Patents, *Waste water treatment, *Water quality control, Neutralization, Hydrogen ion concentration, Acid-base equilibrium, Oxidation, Flocculation, Instrumentation, Equipment.

The amount of acidity, alkalinity, or other ion imbalance in the waste stream must be measured and treated to assure proper neutralization and destruction or conversion of harmful ion concentrations so that waste water discharges are environmentally acceptable and harmless to aquatic life and to other subsequent users of the water. To assure a reliable and thorough treatment appropriate sensing and control loop instrumentation is provided which must be capable of indicating the stream concentration parameters and responding with signals to correct any deviation from an established set point. The apparatus is described for treating waste liquid streams by neutralization, oxi-

dation, or flocculation. Waste liquid and a treating substance, such as an acid or a base, are introduced through a nozzle into a chamber. The rate of addition of treating substance is controlled by deviations from a set point. This invention improves the performance of a conventional continuous treatment system by minimizing the reaction zone with a reduced mixing chamber and by providing rapid response to changes in entering waste liquid quality through a minimum of dead time. (Sinha-OEIS)
W79-04896

PHOSPHATE REMOVAL USING WASTE CALCIUM SULFATE,
Notre Dame Univ., IN. Dept. of Civil Engineering.
T. L. Theis, and G. A. Fromm.
Journal of the Environmental Engineering Division, Vol. 103, No. EE5, p 951-955, October, 1977. 4 fig, 8 ref, append.

Descriptors: *Phosphates, *Calcium sulfate, Water pollution, Water quality, Water quality control, Waste water, Waste water treatment, Sulfates, *Gypsum.

Calcium sulfate (gypsum) is a common mineral which is among the cheapest sources of soluble calcium ion available. Relatively pure calcium sulfate is produced as a byproduct in several industries including chemical, pharmaceutical, and, in the near future, also by high sulfur coal-fired utilities which must remove stack gas SO2. Thus, on a local basis it may be obtained at a markedly reduced cost, transportation being a major cost factor. This study was undertaken to explore the possibility of employing gypsum as a supplemental chemical for the removal of phosphate from wastewaters, and to determine under what conditions it can be utilized. The data suggest that the use of calcium sulfate as a supplemental source of calcium ion for phosphate removal may be a feasible alternative to other processes which use lime alone. Cost savings result from the lower amounts of lime needed and from the fact that there is no need to neutralize the alkaline effluent. (Skogerboe-Colorado State)
W79-04977

5E. Ultimate Disposal Of Wastes

OIL SHALE AND THE ENVIRONMENT,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6B.
W79-04522

ENGINEERING AND ECONOMIC ANALYSIS OF WASTE TO ENERGY SYSTEMS,
Parson (Ralph M.) Co., Pasadena, CA.
For primary bibliographic entry see Field 6B.
W79-04526

POLLUTION CONTROL GUIDANCE FOR GEOTHERMAL ENERGY DEVELOPMENT,
Industrial Environmental Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 5C.
W79-04530

THE UPTAKE AND RELEASE OF PETROLEUM HYDROCARBONS BY THE MARINE MUSSEL MYTILUS EDULIS,
Vandkvalitetsinstitutet, Hoersholm (Denmark).
For primary bibliographic entry see Field 5A.
W79-04588

WASTE INJECTION INTO A TWO-PHASE FLOW FIELD: SAND-BOX AND HELE-SHAW MODELS STUDY,
Hawaii Univ., Honolulu. Dept. of Geology and Geophysics.
F. L. Peterson, J. A. Williams, and S. W. Wheatcraft.
Ground Water, Vol. 16, No. 6, p 410-416, November-December 1978. 9 fig, 5 ref. OWRT-B-043-HI(3), OWRT-A-071-HI(2).

Descriptors: *Injection wells, *Path of pollutants, *Waste water disposal, *Model studies, Laboratory tests, Groundwater, Groundwater movement, Density, Salinity, Saline water-freshwater interfaces, Pollutants, Effluents, Water pollution, Water pollution sources, Dispersion, Buoyancy, Plumes, Effluent plumes, Buoyant plumes.

Sandbox and Hele-Shaw models were used to study waste water injection into two-phase groundwater bodies. Two types of experiments were conducted: 'static' experiments in which there was no movement of the fresh groundwater body with respect to the underlying salt water prior to waste injection, and 'dynamic' experiments in which a fresh groundwater flow field was present prior to and during waste injection. During every experiment, buoyant plumes of injected effluent, which were clearly distinct from the resident aquifer liquids, formed and migrated upward into the lower portion of the freshwater body. Three injection parameters exerted significant control on the movement of the injection plumes; the rate of effluent injection and the strength of the ambient freshwater flow field significantly influence both the vertical and lateral migration of the plumes, and the depth of effluent injection (with respect to the salt/fresh-water interface) influenced the over-all shape of the plumes as well as the lateral migration of the plumes. The principal means of plume movement in these experiments appears to be by fluid displacement processes, rather than by dispersion processes. (Sims-ISWS)
W79-04599

MECHANISM OF ALUMINUM SULFATE RECOVERY FROM LIGNIN SLUDGE (MEKHANISM IZVLECHENIYA SULFAT ALYUMINIYA IZ SHLAM-LIGNINA),
Vsesoyuznyi-Nauchnyi Planovii Otdel Bumazhnoi Promyshlennost, Moscow (USSR).
For primary bibliographic entry see Field 5D.
W79-04643

HAZARDOUS WASTES INPUT INTO CLASS I LANDFILLS,
University of Southern California, Los Angeles. Environmental Engineering Program.
B. Eichenberger, J. Edwards, K. Y. Chen, and R. Stephens.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. EE3, p 385-399, June 1978. 2 fig, 8 tab, 19 ref.

Descriptors: *Water pollution, *Wastes, *Waste disposal, *Metals, *Hazardous materials, Environmental engineering, Sanitary landfill, Liquid wastes, Pollutants.

This study documents 17 metal species discharged to Class I landfill sites. These sites receive a combined estimated daily volume of 2.3 x 10 to the 6th power l/day of hazardous wastes. The metal species are ranked according to their estimated daily total deposition: Na>Fe>Ca>Zn>Mg>Cu>Cr>Ni>Pb>Ba>Mn>V>As>Cd>Be>Ag. Approximately 50% of the total volume of hazardous wastes sampled were generated by the petroleum industry. About 35% of the volume was equally divided between the chemical industry and industrial cleaning. The metal, food, and miscellaneous/unknown industries each contributed less than 10% of the total volume. Approximately 70% of the total volume was in the aqueous phase and 8% consisted of an organic liquid phase. The weight percent of 17 metal species in the soluble phase ranged from less than 10% to a maximum of 90%. The volume flow and concentration of soluble toxic metals pose a potential water quality problem. (Bell-Graf--Cornell)
W79-04715

GEOHYDROLOGY OF THE NORTHERN LOUISIANA SALT-DOME BASIN PERTINENT TO THE STORAGE OF RADIOACTIVE WASTES--A PROGRESS REPORT,
Geological Survey, Baton Rouge, LA. Water Resources Div.
R. L. Hosman.
Geological Survey Water-Resources Investigations 78-104 (open-file report), November 1978. 27 p, 2 fig, 10 plates, 4 tab, 26 ref.

Descriptors: *Underground waste disposal, *Nuclear waste, *Louisiana, *Hydrogeology, *Aquifer characteristics, Radioactive waste disposal, Groundwater movement, Path of pollutants, Water quality, Surface-groundwater relationships, Evaluation, Planning, *Northern Louisiana salt-dome basin, Dissolution.

Salt domes in northern Louisiana are being considered as possible storage sites for nuclear wastes. The domes are in an area that received regional sedimentation through early Tertiary (Eocene) time with lesser amounts of Quaternary deposits. The Cretaceous-Tertiary accumulation is a few thousand feet thick; the major sands are regional aquifers that extend far beyond the boundaries of the salt-dome basin. Because of multiple aquifers, structural deformation, and variations in the hydraulic characteristics of cap rock, the groundwater hydrology around a salt dome may be highly complex. The Sparta Sand is the most productive and heavily used regional aquifer. It is either penetrated by or overlies most of the domes. A fluid entering the Sparta flow system would move toward one of the pumping centers, all at or near municipalities that pump from the Sparta. Movement could be toward surface drainage where local geologic and hydrologic conditions permit leakage to the surface or to a surficial aquifer. (Woodard-USGS)
W79-04810

LEAD ACCUMULATION IN PLANKTON BLOOMS FROM ULLSWATER, THE ENGLISH LAKE DISTRICT,
London Univ. (England). Dept. of Botany; and London Univ. (England). Dept. of Biochemistry.
For primary bibliographic entry see Field 5C.
W79-04819

ACCUMULATION OF HEAVY METALS BY THE MARINE DIATOM DITYLUM BRIGHTWELLII (WEST) GRUNOW,
Melbourne Univ., Parkville (Australia). School of Botany.
For primary bibliographic entry see Field 5C.
W79-04822

BIOLOGICAL CONTROL OF DISSOLVED ALUMINUM IN SEAWATER: EXPERIMENTAL EVIDENCE,
Northwestern Univ., Evanston, IL. Dept. of Geological Sciences.
For primary bibliographic entry see Field 5D.
W79-04824

UPGRADING FACULATIVE WASTEWATER LAGOONS WITH VASCULAR AQUATIC PLANTS,
National Space Technology Labs., NSTL Station, MS.
For primary bibliographic entry see Field 5D.
W79-04830

AN ANALYSIS OF THE FUNCTIONAL CAPABILITIES AND PERFORMANCE OF SILT CURTAINS.
JBF Scientific Corp. Wilmington, MA.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-39, July 1978. 190 p, 78 fig, 7 tab, 2 app, 15 ref.

Descriptors: *Silts, *Sediment control, Turbidity, Barriers, *Dredged material disposal, *Silt curtains.

Where current velocities are less than 0.2 ft/sec, silt curtains that are properly deployed and main-

tained can effectively control dispersion of turbid water in the upper part of the water column. Silt curtain effectiveness depends on nature of the operation, quantity and type of material in suspension, characteristics and configuration of the silt curtain, ethod of deployment and hydrodynamic conditions at the site. Under ideal conditions, turbidity levels in water column outside the curtain can be as much as 80 to 90 percent lower than those levels inside or upstream of the curtain. When silt curtains are used to enclose open-water pipeline disposal operations, 95 percent of dredged material slurry descends to the bottom of the disposal area and forms a fluid mud layer. As current velocities increase, effective depth of the silt curtain is reduced due to flare, and associated turbulence may cause significant resuspension of the fluid mud layer. Silt curtains are not designed to control accumulation of fluid mud and must be moved when fluid mud reaches the depth of the lower skirt edge to prevent burial of the curtain. Silt curtains are not recommended for use in environments where currents exceed 1.5 ft/sec. (WES)
W79-04924

DESIGN CONCEPTS FOR IN-WATER CONTAINMENT STRUCTURES FOR MARSH HABITAT DEVELOPMENT,
Coastal Engineering Research Center, Fort Belvoir, VA.
J. W. Eckert, M. L. Giles, and G. M. Smith.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-31, July 1978. 69 p, 2 app, 2 tab, 6 fig, 27 ref.

Descriptors: *Marshes, *Marsh management, Habitat improvement, Dredged material, *Dredged material disposal, *Containment structures.

Provides general guidance for structure selection and development of structure design concepts for use in habitat development. Various types of structures were reviewed, based on available literature, to determine which would be applicable to habitat use. Planning and design concepts are presented for use of the potential structure types for habitat development. References are provided for detailed design and construction guidelines. Case histories of structures used for habitat development are discussed. A list is provided of the known projects, their locations, and structural types. Few structures have been built specifically to retain or protect dredged material for purposes of habitat creation, however, the predominant structures used for habitat creation have been sand dikes. (WES)
W79-04925

CASE STUDIES AND COMPARATIVE ANALYSES OF ISSUES ASSOCIATED WITH PRODUCTIVE LAND USE AT DREDGED MATERIAL DISPOSAL SITES,
Energy Resources Co., Inc., Cambridge, MA.; and Sasaki Associates Inc., Watertown, MA.
J. J. Gushue, and K. M. Kreutziger.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-77-43, December 1977, in two volumes (Vol. I consists of main text and Vol. II consists of appendixes). 422 p, 19 app, 52 tab, 63 fig, 185 ref.

Descriptors: *Waste disposal, *Land use, *Project planning, *Dredged material disposal, Dredged material.

Compares and evaluates 12 selected cases where dredged material from navigation projects was used to create productive land. Results are directly applicable as a management aid for Corps disposal planners. The principal output was the development of an overall set of 'implementation factors' for disposal-productive use projects. Thirty-seven factors were identified and categorized as environmental, technical, economic/financial, legal, institutional, or planning/implementation. These factors provide a framework for ensuring that project planners address the full range of substantive and procedural considerations that are important to successful project implementation. The case studies provide documented proof disposal-productive use project success is as much affected by procedural factors as by substantive factors. Procedural aspects of each case study are fully delineated in individual case study synopses contained in Volume II of the study report. The detailed comparative analyses of the 12 cases, which led to the identification of the important implementation factors, are also provided in Volume II. The matrix approach enables the site-specific nature of disposal planning to be retained in the analysis while providing a common basis for comparison. As a result, the set of implementation factors is applicable to all disposal situations. (WES)
W79-04926

HABITAT DEVELOPMENT FIELD INVESTIGATIONS, BOLIVAR PENINSULA MARSH AND UPLAND HABITAT DEVELOPMENT SITE, GALVESTON BAY, TEXAS; APPENDIX D: PROPAGATION OF VASCULAR PLANTS AND POST-PROPAGATION MONITORING OF BOTANICAL, SOIL, AQUATIC BIOTA, AND WILDLIFE RESOURCES,
Texas Agricultural Experiment Station, College Station.
J. W. Webb.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-15, June 1978. 772 p, 1 append, 91 fig, 162 tab, 53 ref.

Descriptors: *Habitats, *Wildlife, *Biota, *Texas, On-site investigations, Plant growth, *Dredged material disposal, Dredged material, *Galveston Bay, *Vascular plants.

A 2-1/2-year field investigation was conducted at Bolivar Peninsula to test the feasibility and impact of developing marsh and upland habitat on dredged material. This summarizes baseline information derived before habitat development operations and results of post-development operation. Two marsh grass species and nine upland plant species including trees, shrubs, and grasses were planted in test plots on a dredged material site lying between the Gulf Intracoastal Waterway and Galveston Bay. Tests were conducted to measure plant survival and performance in response to different fertilizer treatments and planting methods. Plantings of the marsh grasses were made within an intertidal area protected from wave energies by a sandbag dike. Prior to and during plant development, information was collected to document changes in fish and wildlife communities. After less than a year of development, the site provided heterogeneous habitats which tended to support greater use by fish and benthos than generally associated with sandy shores along Bolivar Peninsula. This indicated habitat development can be a feasible dredged material disposal alternative. (WES)
W79-04927

AQUATIC DISPOSAL FIELD INVESTIGATIONS, DUWAMISH WATERWAY DISPOSAL SITE, PUGET SOUND, WASHINGTON; APPENDIX D: CHEMICAL AND PHYSICAL ANALYSES OF WATER AND SEDIMENT IN RELATION TO DISPOSAL OF DREDGED MATERIAL IN ELLIOTT BAY, VOL. I, FEB - JUNE 1976,
Corvallis Environmental Research Lab., OR. Marine and Freshwater Ecology Branch.
For primary bibliographic entry see Field 5C.
W79-04928

AQUATIC DISPOSAL FIELD INVESTIGATIONS, DUWAMISH WATERWAY DISPOSAL SITE, PUGET SOUND, WASHINGTON; APPENDIX D: CHEMICAL AND PHYSICAL ANALYSES OF WATER AND SEDIMENT IN RELATION TO DISPOSAL OF DREDGED MATERIAL IN ELLIOTT BAY; VOL. II: SEPT.-DEC. 1976,
Washington Univ., Seattle. Lab. of Radiation Ecology.
For primary bibliographic entry see Field 5B.
W79-04929

NEEDS AND AREAS OF POTENTIAL APPLICATION OF DISPOSAL AREA REUSE MANAGEMENT (DARM),
Army Engineer Waterways Experiment Station, Vicksburg, MS.
M. R. Palermo.
Technical Report D-78-27, June 1978. 46 p, 11 fig, 27 ref, 2 tab.

Descriptors: Disposal Area Reuse Management(DARM), Dredged material, *Dredged material disposal.

Documents the results of a survey of Corps of Engineers (CE) Districts for needs and areas of potential application of Disposal Area Reuse Management (DARM). Under the DARM concept, disposal areas are regarded as collection and processing sites where dredged material is rehandled within the site or totally removed, thereby increasing or restoring site capacity for subsequent disposal. A total of nine CE Districts were surveyed regarding DARM. Critical shortages of confined disposal capacity was found to exist in many areas throughout the country. However, Districts are generally reluctant to restore sites through DARM where provision of disposal sites is the sole responsibility of the local sponsor. Acquiring additional disposal sites is considered the most economical solution to shortages of capacity. Where responsibility for providing disposal sites lies with the government, DARM is considered an alternative to acquiring additional sites, provided technical constraints can be resolved and economic feasibility determined. Technical feasibility of full-scale application of DARM is demonstrated by the success of ongoing programs in the Philadelphia and Sacramento Districts. In areas where fine-grained material predominates, technical constraints concerning dewatering, removal, and transport must be resolved before DARM concepts may be implemented on a large scale. (WES)
W79-04930

VERTICAL MIGRATION OF BENTHOS IN SIMULATED DREDGED MATERIAL OVERBURDENS; VOL. I: MARINE BENTHOS,
Delaware Univ., Lewes. Marine Studies Complex.
D. L. Maurer.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-35, June 1978. 108 p, 29 tab, 63 ref, 1 fig, 1 append.

Descriptors: *Environmental effects, *Benthos, *Vertical migration, *Dredged material disposal, *Waste disposal sites, Dredged material.

Determines effect of simulated dredged material disposal on vertical migration ability and survival of benthic invertebrates. Many species tested showed a surprising ability to vertically migrate and survive in relatively thick deposits of native and exotic sediments. Since surface water chemistry appeared more conducive to the survival of benthic organisms than pore water chemistry, the organisms may have needed to reestablish direct or indirect contact with the surface waters via siphons, or tubes through dredged material overburden. Assuming worst-case laboratory conditions, vertical migration may be an important factor in the recovery of benthic communities in dredged material disposal areas. Mortalities generally increased with increased sedimet depth, with increased burial time, and with overlying sediments whose particle size distribution differed from that of the animals' preferred habitat. Temperature affected mortalities under certain conditions, but percent migration was more responsive than mortality to temperataure. In addition, mortality and percent migration were influenced by synergistic effects of experimental variables. Because physiological conditions of animals differ, caution should be used when applying these results to other areas and animals with morphology similar to those tested. However, the morphological and habitat approach can be used to develop a dependable method for prediction. (WES)
W79-04931

A METHODOLOGY FOR DETERMINING LAND VALUE AND ASSOCIATED BENEFITS CREATED FROM DREDGED MATERIAL CONTAINMENT,
SCS Engineers, Reston, VA.
E. T. Conrad, and A. J. Pack.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-19, June 1978. 116 p, 15 append, 12 tab, 2 fig.

Descriptors: *Land, *Evaluation, *Value, *Containment areas, *Dredged material, *Waste disposal sites.

Presents a step-by-step methodology for determining land values and associated benefits from the productive use of dredged material containment sites. A discussion of productive uses of dredged material sites, their physical characteristics, institutional and legal constraints, and local land demand is included, as well as an overview of property valuation. Site description, establishment of use potential, value estimation, and associated benefits and impacts are discussed. Working tables are presented. The resulting land value and the associated benefits and impacts created by dredged material containment should be explicit inputs to the formulation of plans in according with Principles and Standards for Water and Related Resource Planning and Corps of Engineers regulations. Fifteen case studies of productively used dredged material containment sites were conducted to validate and refine the methodology. One of the case studies was used in this report as a site-specific example of how methodology can be applied. All fifteen case studies are included as Appendices A through O. (WES).
W79-04933

DEVELOPMENT OF PROCEDURES FOR SELECTING AND DESIGNING REUSABLE DREDGED MATERIAL DISPOSAL SITES,
Acres American Inc., Buffalo, NY.
T. E. Raster, D. C. Steuernagel, H. S. Gill, and D. J. Lipiro.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-22, June 1978. 339 p, 3 append, 86 fig, 32 tab, 44 ref.

Descriptors: *Environmental effects, *Dredged material disposal, *Waste disposal sites.

Presents a logical, step-by-step methodology for site selection and design of reusable dredged material disposal sites. The methodology is capable of handling anything from a single disposal site serving a sinlge dredging location to an entire dredging program involving several dredging locations and disposal sites. Pertinent factors--legal, enivronmental, and technological--which influence selection of candidate disposal sites and determine their suitability as reusable and nonreusable sites are identified. Site design and operating recommendations are presented, along with a preliminary costing procedure to enable evaluation of alternative disposal options for each site and cost modifications of the entire dredging program. Numerical examples are provided to assist the reader in applying the procedures to his particular case. Although this report promotes reusable disposal sites, nonreusable sites of a nonconventional nature are also discussed for situations where reusable sites are inapropriate or economically unsound. (WES)
W79-04934

5F. Water Treatment and Quality Alteration

ION-EXCHANGE PRETREATMENT OF WATER AFTER RESIN REGENERATION WITH REVERSE OSMOSIS REJECT BRINE,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
R. J. Eisenhauer, and R. W. Schiller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 972, Price codes: A02 in paper copy, A01 in microfiche. Report No. REC-ERC-77-15, April 1977. 20 p, 5 fig, 8 tab, 4 ref.

Descriptors: *Ion exchange, *Water treatment, *Pre-treatment(Water), Separation techniques, Desalination, Electrodialysis, Reverse osmosis, Membrane processes, LaVerkin Springs(Utah), Water quality, Calcium, Sulfates.

Calcium must be removed from the feed water for electrodialysis (ED) and reverse osmosis (RO) desalting processes to prevent membrane fouling by calcium sulfate. Pretreatment using the ion exchange (IX) method entails a continuous cycling, one process unit operation with low operating and capital costs. Water imported from LaVerkin Springs, Utah, was tested at the Bureau Testing Desalinization Test Station, Longmont, Colorado, using the IX pretreatment method. The calcium in the raw LaVerkin Springs (LVS) water was reduced below sulfate fouling concentration by IX, desalting was accomplished by RO, and the recovered reject brine was used for regenerating the spent IX resin. Test results show that IX pretreatment of LVS water can be operated as a closed-loop exhaustion-regeneration cycle, and only the reject brine from RO need be used to regenerate the IX resin. (Davison-IPA)
W79-04505

A PILOT PLANT STUDY TO PROVIDE IMPROVED QUALITY FEED WATER FOR THE WEBSTER, SOUTH DAKOTA ELECTRODIALYSIS PLANT,
Johns-Manville Research and Engineering Center, Manville, NJ.
G. R. Bell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-178 522, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 201, August 1966. 34 p, 12 fig, 6 tab, 1 append. 14-01-0001-616.

Descriptors: *Water treatment, *Water quality control, *Membrane, *Pilot plants, Pretreatment(Water), Waste treatment, Electrodialysis, Iron, Manganese, Organic matter, Silica, Filtration, Water purification, Design criteria, Webster(South Dakota).

A pilot plant study was undertaken when analysis of published reports indicated that slippage of unremoved iron and manganese in treated well water supplied to the Webster, South Dakota, electrodialysis plant could adversely affect the electrical and dialytic properties of the membranes. Silica and organic matter also appeared to contribute to the membrane problems. The specific objectives of the program included the removal of iron by the fiber aid-MgO process demonstration, removal of manganese by the use of filter aid and KMnO4 demonstration, determination of the extent of silica removal, and determination of the extent of organic matter removal using filter aid filtration and granular activated carbon clean up. A treatment system providing improved quality feed water to the electrodialysis plant was developed in which very low levels of iron and manganese were attained and organic matter was greatly reduced; silica was not appreciably reduced. Parameters were developed for the design of a full sized pretreatment unit and operating costs, except for granular activated carbon, were estimated. (Davison-IPA)
W79-04510

ESTIMATING COSTS FOR WATER TREATMENT AS A FUNCTION OF SIZE AND TREATMENT PLANT EFFICIENCY,
Culp, Wesner, Culp, Santa Ana, CA.
For primary bibliographic entry see Field 6B.
W79-04527

CHEMICAL PRECIPITATION-COAGULATION FOR ORGANIC COLOR REMOVAL FROM GROUNDWATERS,
Mississippi State Univ., Mississippi State.
J. E. Bowie, Jr., and M. T. Bond.
Water Resources Bulletin, Vol. 13, No. 6, p 1269-1280, December 1977. 6 fig, 3 tab, 4 ref. OWRT-A-084-MISS(4), 14-31-0001-5024.

Descriptors: *Organic compounds, *Chemical precipitation, *Chemical treatment system, Coagulation, *Groundwater, Wells, Mississippi, Sampling, Alum, Polyelectrolyte, Rapid mix, Flocculation, Jar tests.

Many wells produce water that is highly colored by organic substances. Colored water may cause aesthetic, economic, and health problems for the cities using it as a municipal supply. Characterization of water from a number of wells showed that the color causing compounds were hydroxylated aromatic carboxylic acids which were precipitated below pH 4.5 and were almost completely ionized above pH 4.5. Through jar tests, a chemical precipitation-coagulation treatment system was developed. The optimal sequence of chemical addition was alum first, followed by pH adjustment and addition of polyelectrolyte. Rapid mix tests demonstrated (1) need for a reaction period after alum and after acid addition, (2) that the rapid mix time controlled flox size for a given flocculation period. Flocculation tests, varying both the floc time and mean velocity gradient, G, showed that an optimum G exists for each floc time and that the residual color decreased with decreasing values of velocity gradient. (Graf-Cornell)
W79-04614

REDUCTION OF AQUEOUS HOCL WITH ACTIVATED CARBON,
Georgia Inst. of Tech., Atlanta. Dept. Civil Engineering.
M. T. Suidan, V. L. Snoeyink, and R. A. Schmitz.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 103, No. EE4, p 677-691, August 1977. 5 fig, 14 ref, 3 append. OWRT A-066-ILL(2), 14-31-0001-5013.

Descriptors: *Simulation analysis, *Activated carbon, *Chlorine, Aqueous solutions, Mathematical models, Chemical reactors, Transport phenomena, Sanitary engineering.

A mathematical model describing the unsteady state of chlorine removal from water by activated carbon is developed and tested. Constants in the model, which account for intraparticle diffusion and surface reaction, are determined from semi-batch experiments in which the level of free chlorine, present in all cases as HOCl, is maintained constant. The resulting model is tested for its adequacy in describing experimental results obtained from a closed batch reactor in and from a fixed-bed reactor for several sets of conditions including different particle sizes. Very close agreement is demonstrated between experimental results (in the form of effluent chlorine concentration versus time) model predictions. (Graf-Cornell)
W79-04615

ENERGY FOR PRODUCTION OF CONSUMABLE MATERIALS,
Culp/Wesner/Culp, Santa Ana, CA.
For primary bibliographic entry see Field 5D.
W79-04713

SOLUTION OF GRANULAR BED FILTRATION EQUATIONS,
Ministry of the Interior, Jerusalem (Israel). Water Quality.
A. Adin.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. EE3, p 471-484, June 1978. 5 fig, 16 ref.

Descriptors: *Water treatment, *Filters, *Environmental engineering, *Filtration, *Mathematics, Bed forms, *Granular media, Adsorption, Computers, Numerical techniques, Optimizaton, Prediction, Mathematical models, Equations, Systems analysis.

Mathematical models based on filtration theory may play an important role in pilot plant studies of granular bed filtration. A semianalytical solution of such a model is presented, solving the material balance and the kinetic equations to provide con-

centration, specific deposit and gradient variations with filtrate volume and bed depth. A transformation of the filtration equations yields a quasilinear hyperbolic partial differential equation which is solved numerically using the 'method of characteristics.' The method, the numerical analysis and the computer program are explained in detail. The solution enables the use of filtration equations to predict filter performance and optimize design by feeding the computer with the filtration parameters obtained by pilot experiments. It is also applicable to other accumulation processes, i.e., fixed-bed adsorption, which have a similar conservation equation. (Bell-Graf--Cornell)
W79-04716

SOCIAL AND ECONOMIC ASPECTS OF WATER EXPLOITATION,
For primary bibliographic entry see Field 6B.
W79-04760

PROCESS FOR THE SEQUESTRATION OF OXYGEN DISSOLVED IN WATER AND COMPOSITIONS USEFUL FOR SUCH PURPOSE,
Etablissements Kuhlmann, Paris (France). Produits Chimiques. (Assignee).
B. Arghiropoulos, and A. P. N. Tignol.
U.S. Patent No. 4,124,500, 3 p, 2 tab, 9 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 1, p 236, November 7, 1978.

Descriptors: *Patents, *Water treatment, *Industrial water, Oxygen, Chemical reactions, Water quality, Boiler water.

A process is disclosed for eliminating oxygen dissolved in water. A hydrazine solution containing an activator is added to the water. The role of such compounds is merely to increase the reaction speed of the hydrazine with respect to such oxygen, and the amount of such compounds used is much less than the amount of oxygen to be eliminated and, also, much less than the amount of hydrazine employed. These solutions are usually used in the present treatment of boiler waters. (Sinha-OEIS)
W79-04884

TREATMENT OF WATER,
CIBA-GEIGY Ltd., London (England). (Assignee).
T. I. Jones, G. Graham, and M. A. Finan.
U.S. Patent No. 4,126,549, 10 p, 1 fig, 10 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 3, p 937, November 21, 1978.

Descriptors: *Patents, *Water treatment, *Industrial water, *Water softening, Scaling, Corrosion, Alkaline earth metals, Polymers.

A method of prevention of scale and the inhibition of corrosion in aqueous systems consists of the use of low molecular weight hydrolyzed terpolymer of maleic anhydride with two other ethyl-enically unsaturated monomers, preferably vinyl acetate and ethyl acrylate. The use of such terpolymers at very low concentrations in water prevents the build-up of alkaline earth sulphates as well as carbonates in heat transfer equipment, boilers, oil well drilling operations and the like. (Sinha-OEIS)
W79-04885

5G. Water Quality Control

ECONOMIC AND ENERGY ANALYSES OF REGIONAL WATER POLLUTION CONTROL,
Oregon State Univ., Corvallis. Water Resources Research Inst.
For primary bibliographic entry see Field 6B.
W79-04523

NITRATE AND PHOSPHORUS RUNOFF LOSSES FROM SMALL WATERSHEDS IN GREAT LAKES BASIN,
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
For primary bibliographic entry see Field 5C.
W79-04535

EFFECTS OF DIVERSION AND ALUM APPLICATION ON TWO EUTROPHIC LAKES,
Kent State Univ., OH. Dept. of Geology.
For primary bibliographic entry see Field 5C.
W79-04536

NITRATES IN WATER SUPPLY ABSTRACTIONS IN THE ANGLIAN REGION: CURRENT TRENDS AND REMEDIES UNDER INVESTIGATION,
Anglian Water Authority (England). Public Health and Water Supplies.
For primary bibliographic entry see Field 5A.
W79-04570

THE APPLICATION OF OPTIMAL LINEAR REGULATOR THEORY TO A PROBLEM IN WATER POLLUTION,
Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 7B.
W79-04596

WATER-CONSERVATION METHODS TO MEET PENNSYLVANIA'S WATER NEEDS,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
For primary bibliographic entry see Field 3D.
W79-04598

SIMULATION OF URBAN NON-POINT SOURCE POLLUTION,
CH2M/Hill, Redding, CA.
For primary bibliographic entry see Field 5B.
W79-04609

AGRICULTURE AND SALINITY,
B. D. Gardner, and C. E. Stewart.
In: Values and Choices in the Development of The Colorado River Basin, The University of Arizona Press, Tucson, Arizona, 1978, p 121-143. 7 fig, 4 tab, 14 ref.

Descriptors: *Colorado River, Colorado River Basin, *Return flow, Water pollution control, Water pollution sources, Salinity, Mexican water treaty.

This paper discusses the saline return flow problems of the Colorado River due to irrigated agriculture of the Colorado River Basin. (Skogerboe-Colorado State)
W79-04659

INTERNATIONAL PROBLEMS,
For primary bibliographic entry see Field 6E.
W79-04660

FUNDAMENTAL RESEARCH NEEDS FOR WATER AND WASTEWATER TREATMENT SYSTEMS,
For primary bibliographic entry see Field 5D.
W79-04852

WATER MANAGEMENT POLICIES AND INSTRUMENT,
Organization for Economic Co-Operation and Development, Paris (France).
1977, 157 p.

Descriptors: *Water policy, *Water management(Administrative), *Water management instruments, *Institutions, *Water resources management, Social aspects, Economic efficiency, Pollution charges, Water technology, Water quality, Water pollution control, Water quantity, Effluent discharge, Water use, Canada, Finland, France, Germany, Japan, The Netherlands, United Kingdom, United States, Economic instruments, Legal instruments, Regulation, Economics.

This report is a follow-up to 8 OECD Member country monographs on economic and policy instruments for water management. The major purposes of the study are: to provide information on water management instruments; to see how impacts and results of using these instruments can be assessed; to place water policy in a general social, political, economic and technical context; and to enable Member countries to improve or establish water management systems. The main objectives of water policy are equitable treatment of users, economic efficiency, development and regional planning, qualitative and quantitative improvement of water resources, cooperation with local administrations, and cooperation with water authorities of other countries. Water management requires substantial scientific, technical and industrial resources. Public participation in policy decisions is needed. Coordination of different types of water management and increasing use of the regional level as the focus for solving water management problems are recommended. Two types of water management instruments are discussed--legal and economic. Legal instruments include controls on the use of water--on abstraction and consumption and on waste water discharged; control by objectives--quality targets, regional planning and development; and technological objectives in water treatment. Economic instruments include fund-raising instruments, use of the 'polluter pays' principle, and financial charges to encourage low water use and good management practices. The effectiveness of the water management instruments is presented. Recommendations include construction of a reference statistical framework; development of standard indicators; development of integrated water management; inclusion of short-term problems in the long-term objectives selected for water policy; and progressive increases in pollution charges. (Cooper-NC)
W79-04856

ULTRASONIC OIL SPILL REMOVAL,
A. Kuris.
U.S. Patent No. 4,126,547, 9 p, 2 fig, 3 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 3, p 936, November 21, 1978.

Descriptors: *Patents, *Oil spills, *Oil pollution, *Water pollution treatment, Water quality control, Dispersion, Ultrasonics, Homogeneity, Absorption.

Oil slicks on surface waters are dispersed by the exposure of the surface oils to ultrasonic energy to effectuate an homogenization of the oil and water to permit absorption of the oil within the total volume of water. The device for homogenization of the oil into the body of water uses an output radiator or ultrasonic motor for generating longitudinal vibrations of large displacement amplitude adapted to produce periodic perturbations in the oil and reflecting means in a facing relation. The oil to be dispersed is funneled through the gap between the ultrasonic motor and reflecting means for reflecting the vibrations back into the fluid medium consisting of the oil layer and water. The reflecting surface is spaced from the generating means output surface a distance such that the reflected vibrations are substantially in phase with the vibrations radiated into the fluid medium by the output radiator. In this manner, the displacement amplitude of the fluid medium perturbations are increased for the release of oil particles into the fluid primarily by the selective entrainment characteristics of the viscous forces generated by the perturbating medium. The means for removing the dispersed oil particles may include vacuum means for suctioning off the liquid and particles or a fluid sluice means for directing a stream of fluid through a permeable screen. (Sinha-OEIS)
W79-04882

PURIFYING OIL SHALE RETORT WATER,
University of Southern California, Los Angeles. (Assignee).
For primary bibliographic entry see Field 5D.
W79-04883

FLOTATION MEANS FOR BARRIER FOR WATER CARRIED POLLUTANTS AND METHOD OF MAKING SAME,
P. Preus.
U.S. Patent No. 4,124,981, 7 p, 6 fig, 7 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 2, p 406, November 14, 1978.

Descriptors: *Patents, *Water pollution control, *Water quality control, Oil pollution, Barriers, Floating, *Oil booms, Containment, Closed-cell foam.

Floating barriers, known generally as oil booms, have great utility in containing and controlling oil slicks and other water carried pollutants on and in bodies of water. This invention is composed of a series of boom sections which are connectable in end to end relationship with each of the boom sections containing a flotation material. The flotable material comprises closed-cell foam, hollow, cylindrical blocks and end closure members for each end of each block. The method of making closed-cell foam, cylindrical block is by rolling and edge sealing a sheet of closed-cell foam material and then sealing end members to each end of eacy cylinder. (Sinha-OEIS)
W79-04891

FLASH REACTOR,
For primary bibliographic entry see Field 5D.
W79-04896

OIL SPILLS: THE STRATEGY OF RECOVERY,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 5C.
W79-04904

APPLICATION OF LAND TREATMENT FOR WATER QUALITY IMPROVEMENT,
Purdue Univ., Lafeyette, IN. Dept. Agricultural Engineering.
R. Z. Wheaton.
Paper No. 78-2533, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Palmer House Hotel, Chicago, Illinois, 3 p. ASAE, St. Joseph, Michigan.

Descriptors: Water quality control, *Land management, Control structures, Cultural control, Soil conservation, Agricultural watersheds, Small watersheds, *Non-point pollution.

Application of land treatment measures is considered to be a means of controlling agricultural non-point pollution. Experiences gained during a demonstration project of these principles is reviewed. The problems of absolute water quality standards and monitoring for compliance of non-point pollution are discussed and alternatives suggested. (Skogerboe-Colorado State)
W79-04905

SUBSURFACE DRAINAGE SYSTEMS INSTALLATIONS IN ARID LANDS--THE STATE OF THE ART,
Advanced Drainage Systems, Inc., Fresno, CA. Dept. of Agricultural Engineering.
G. True.
Paper No. 78-2528, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Palmer House Hotel, Chicago, Illinois, 2 p. ASAE, St. Joseph, Michigan.

Descriptors: *Subsurface drainage, *Arid lands, Equipment, Materials, Trenches, Irrigated land.

Agricultural drainage contractors are quickly adapting to new techniques and equipment that result in better and more efficient drainage systems. These relatively inexpensive drainage systems are maintaining the long-term viability of irrigated agriculture and increasing crop yields far above the value of energy and capital invested in drainage. (Skogerboe-Colorado State)
W79-04907

DRAINAGE REQUIREMENTS FOR LOWLAND RICE,
Utah State Univ., Logan. Dept. of Agriculture and Irrigation Engineering.
R. C. Undan, A. L. Phillips, and R. W. Hill.
Paper No. 78-2041, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 21 p. 10 fig, 5 tab, 2 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Drainage, *Rice, Drainage effects, Submerged plants, Submergence, Rainfall, Simulation analysis, Computer models.

Field experiments were conducted in the Philippines with the IR-30 variety to determine the effects of depth and duration of submergence on rice yields, and the data used with rainfall and other physical information as bases for developing guidelines for drainage system capacity selection. (Skogerboe-Colorado State)
W79-04908

AGRICULTURAL DRAINAGE PROBLEMS IN KERN COUNTY, CALIFORNIA,
Kern County Water Agency, Bakersfield, CA.
M. R. Rector, and W. W. Donnan.
Paper No. 78-2532, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Palmer House Hotel, Chicago, Illinois, 15 p. 3 fig. ASAE, St. Joseph, Michigan.

Descriptors: *Drainage, Drainage area, *Tile drainage, Crop production, Perched water, Salinity, Drilling, Water table, California.

This paper describes procedures followed in the diagnosis, monitoring and evaluation of the drainage problem areas within Kern County, California as a case history for use by others who are facing these same problems. (Skogerboe-Colorado State)
W79-04909

DRAINAGE INSTALLATION EQUIPMENTS 'ECONOMICS OF THE ART',
Speicher Corp., Celina, OH.
C. W. Marsee.
Paper No. 78-2527, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Palmer House Hotel, Chicago, Illinois, 9 p. ASAE, St. Joseph, Michigan.

Descriptors: Drainage, *Subsurface drains, Equipment, Trenches, Costs.

This paper has two objectives. First, to make the drainage contractor more aware of his cost of operation and his return on investment. Second, to illustrate the cost of operation and return on investment between the wheel and chain trenching machines. (Skogerboe-Colorado State)
W79-04910

FINANCING REGIONAL DRAINAGE FACILITIES UNDER 1978 ECONOMIC CONDITIONS,
Westlands Water District, Fresno, CA.
W. R. Johnston, and L. A. Beck.
Paper No. 78-2535, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Palmer House Hotel, Chicago, Illinois, 12 p. 3 fig, 3 tab. ASAE, St. Joseph, Michigan.

Descriptors: Drainage programs, *Drainage, Financing, Salinity, California, *Cost-benefit analysis, Crop production, Surface drainage, Subsurface drainage.

The benefits, costs, and a recommended financial program to solve saline drainage problems on over 400,000 hectares (1,000,000 acres) of irrigated land in the San Joaquin Valley of California, USA, are discussed. The need to provide long-term financing for major drainage facilities is demonstrated. (Skogerboe-Colorado State)
W79-04911

TRENCHLESS DRAINAGE,
Advanced Drainage Systems, Inc., Columbus, OH.
For primary bibliographic entry see Field 8A.
W79-04912

INTERCEPTOR DRAINS ON SLOPING LAND,
Washington State Univ., Pullman. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 4A.
W79-04916

DESIGN AND OPERATION OF GRADIENT TERRACE SYSTEMS,
Soil Conservation Service, Des Moines, IA.
For primary bibliographic entry see Field 2J.
W79-04918

AN ANALYSIS OF THE FUNCTIONAL CAPABILITIES AND PERFORMANCE OF SILT CURTAINS.
JBF Scientific Corp. Wilmington, MA.
For primary bibliographic entry see Field 5E.
W79-04924

GROUNDWATER AND SALINITY IN THE GRAND VALLEY OF COLORADO,
Science and Education Administration, Fort Collins, CO.
E. G. Kruse.
Paper No. 78-2530, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois. 21 p, 5 fig, 3 tab, 14 ref. ASAE, St. Joseph, Michigan.

Descriptors: Salinity, *Saline water, Saline soils, Salts, *Groundwater, Colorado, Colorado River.

This paper describes causes and magnitudes of groundwater flows and salt loading in the Grand Valley in western Colorado. Structural measures and management practices most likely to reduce salt loading are described. (Skogerboe-Colorado State)
W79-04985

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

METHODOLOGY FOR DESIGNING COST-EFFECTIVE MONITORING AND COMPLIANCE STRATEGIES FOR PESTICIDE USE,
CONSAD Research Corp., Pittsburgh, PA.
A. D. Bernstein, and R. A. Lowrey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 114, Price codes: A10 in paper copy, A01 in microfiche. EPA-600/5-78-020, September 1978. 195 p, 42 tab, 4 append. 68-03-2448.

Descriptors: *Pesticides, *Methodology, *Monitoring, *Enforcement, *Regulation, *Problem identification and ranking, Local governments, Poisons, Pollutants, Environmental effects, Administration, Federal insecticide, Fungicide, and Rodenticide Act, Federal Environmental Pesticide Control Act, Cost-effectiveness, Public health, Legal aspects, Legislation, Model studies.

To assist in implementing provisions of the 1972 Federal Environmental Pesticide Control Act (FEPCA) which amended the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) of 1947, this project assesses the need for and feasibility of developing a methodology for designing cost-effective monitoring and compliance programs, and develops such a methodology. It is noted that the study was not undertaken to actually design specif-

ic monitoring and compliance strategies, but only to ascertain need and feasibility of a design methodology, and to develop a prototype. A method, described in detail, includes: (1) conceptualizing and analyzing the local-level scope and effects of misuse; (2) ranking misuse according to potential damages at the local level; (3) local, state, and regional monitoring of misuse and damages; (4) analyzing and modelling user procedures and behavior; and (5) designing and evaluating compliance strategies. (Lynch-Wisconsin)
W79-04524

IMPROVEMENT OF THE STEADY FLOATING RANDOM WALK MONTE CARLO METHOD NEAR STRAIGHT LINE AND CIRCULAR BOUNDARIES WITH APPLICATION TO GROUNDWATER FLOW,
Kansas Water Resources Research Inst., Manhattan.
For primary bibliographic entry see Field 2F.
W79-04557

A SIMPLIFIED MODEL OF CORN GROWTH UNDER MOISTURE STRESS,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2D.
W79-04607

ON THE CHOICE OF THE 'APPROPRIATE MODEL' FOR WATER RESOURCES PLANNING AND MANAGEMENT,
Harvard Univ., Cambridge, MA. Dept. of City and Regional Planning.
P. Rogers.
Water Resources Research, Vol. 14, No. 6, p 1003-1010, December 1978. 4 fig, 6 tab, 14 ref. OWRT C-7095(6208)(1), 14-34-0001-6208.

Descriptors: *Planning, *Management, *Model studies, Irrigation, Optimization, Project planning, Evaluation, Linear programming, Stochastic programming, Systems analysis, Nonlinear programming, Quadratic programming.

The use of symbolic models has become widespread in water resources planning and management. The operations research literature, however, gives little guidance as to the choice of the most appropriate model for any situation. Outlined herein is a method for comparing models of differing complexity applied to a given situation. The hypothesis that simpler models are more appropriate than more representative but more complex models is tested on two simple irrigation examples. In the first example, the problem is to maximize the net revenue; considered are both a linear and a nonlinear programming model for analyzing this particular problem. The second example considers the choice of appropriate stochastic programming model. The process of cropping choice is modeled using four types of model: (1) linear programming to maximize expected return; (2) factile programming to maximize some fractile of the cumulative distribution; (3) a Markowitz progrm for minimizing variance; and (4) a utility. It is concluded that there is no strong evidence that the less complex models are a more appropriate choice than the more complex ones. However, the possiblility is raised that the errors associated with the choice of the simpler models do lie well within the range of errors that one might expect due to the estimation of parameters in the more complex models. (Bell-Graf-Cornell)
W79-04612

RESERVOIR SYSTEM OPERATING POLICY--CASE STUDY,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
G. H. Toebes, and C. Rukvichai.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. WR1, p 175-191, November 1978. 7 fig, 7 tab, 2 equ, 12 ref. OWRT C-4213(No.9083)(3) 14-31-0001-9083.

Descriptors: *Reservoirs, *Performance, Regulation, Algorithms, Systems analysis, Operating policy, Optimization, Recreation, Simulation analysis, Methodology.

A systematic study was made of the daily or 'short-run' operating practices for an existing reservoir system, consisting of four flood control reservoirs in the Green River basin, Kentucky, having recreation as a secondary objective. Optimization and simulation were combined, with the former serving as a screening tool. Official 'long-run' operating rules were cast into algorithmic form using two system state vectors. Iterative adjustments were then made until the algorithm, called POLICY, yielded a reasonable simulation of a series of around 3,000 historic daily reservoir release decision sets. An algorithm like POLICY permits generating relevant statistical aggregations of short-run and long-run operating practices. This type of condensation of practical operating experience is seen as : (1) a missing link in the search for unifying views of reservoir systems analysis; (2) an essential building block in the construction of practical 'on-line operation' models as well as of 'design analysis' models for use by reservoir regulation staffs of water agencies; and (3) an aid to researchers concerned with technology transfer, i.e., those who seek to judge or increase the applicability of reservoir systems analysis work. (Bell-Cornell)
W79-04616

PLANNING STORM-DRAINAGE SYSTEMS FOR URBAN GROWTH,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
For primary bibliographic entry see Field 6F.
W79-04618

MATHEMATICAL MODELING OF PESTICIDES IN THE ENVIRONMENT,
Environmental Research Lab., Athens, GA.
For primary bibliographic entry see Field 5B.
W79-04648

WATER IN LAND USE PLANNING.
New Mexico Wate Resources Research Inst., Las Cruces.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 670, Price codes: A07 in paper copy, A01 in microfiche. WRRI 007, August 1972. Proceedings of the Seventh Annual New Mexico Water Conference, Las Cruces, April 6-7, 1972. 146 p, 45 fig, 14 tab, 19 ref. OWRT A-999-NMEX1(9).

Descriptors: *Land use, *Planning, *Water reso

A compilation of the 17 papers presented at a conference sponsored by the New Mexico Water Resources Research Institute is given. The areas covered include: a progress report on the Bureau of Reclamation's Project Skywater; desalintion; the citizen's role in water and land use planning; groundwater planning for the Mesilla Valley; water use data interpretation for the Rio Grande in New Mexico; hydrologic applications of tritium data; resource management; and potential applications of aerospace earth observations technology to problems of the Rio Grande. The papers of the two panel discussions on water in land development and citizens water conferences are included. (Davison-IPA)
W79-04681

IIASA CONFERENCE' 76.
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
Proceedings of the IIASA Conference '76, Volume 2. International Institute for Applied Systems Analysis, Laxenburg, Austria, 1976. 251 p, 85 fig, 10 tab, 125 ref, 2 append.

Descriptors: *Systems analysis, *Resources, *Environment, *Management, *Technology, *Water resources, *Human settlements, *Human services, Decision making, Regional analysis, River basins, Planning, Computers, Networks, Urban development, Health care, Mathematical models, Equations, Analytical techniques.

A major forum for review of the creation, development, research, and future role of IIASA, this Conference provides a comprehensive report on the first three years of the Institute. This Volume 2 of the proceedings contains presentations, comments, and discussions in the following research areas: Resources and environment, including studies of the Tisza and Vistula River basins, the application of multiattribute utility theory to development planning, and the use of on-line prediction techniques to forecasting short-term agricultural water demand; human settlements and services, including modeling of health care systems, the development of regional land-use models, and inter-regional variations in public goods and services; management and technology, including models and decision-making in integrated regional development; and system and decision sciences, covering a PILOT linear programming model for assessing physical impact on the economy of a changing energy picture, computer networking, and resilience and related mathematical concepts. The table of contents of Volume 1 is appended. (See also W79-04687 thru W79-04689) (Bell-Graf--Cornell)
W79-04686

TISZA AND VISTULA RIVER BASINS: CASE STUDIES,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
Z. Kaczmarek.
In: IIASA Conference '76, Volume 2. The International Institute for Applied Systems Analysis, Laxenburg, Austria, p. 3-7, 1976. 2 fig.

Descriptors: *Water resources, *Planning, *Water management(Applied), *Systems analysis, *River basins, Optimization, Mathematical models, Simulation analysis, Regional analysis, Projects, Programs, Physical processes, Social aspects, Economic aspects.

This brief article considers IIASA case studies in which systems analysis has been applied to derive optimal water resources management in the Tisza and Vistula River basins. Presented is an example of a typical planning scheme wherein the following kinds of models are included: hydrologic, hydrodynamic, transportation, dispersion, water demand, and self-purification of wastes models. Discussed is the question of how to relate the concepts of systems analysis to the problems of regional water resources management. It is concluded that the techniques developed and tested within the framework of the Vistula and Tisza projects have proved to be feasible and technologically workable. The attempt to incorporate in the planning process a specific computational capability to screen, simulate and optimize alternative water resources development programs has demonstrated the merits of the systems approach. (See also W79-04686) (Bell-Graf--Cornell)
W79-04687

APPLYING MULTIATTRIBUTE UTILITY THEORY TO EVALUATION OF TISZA RIVER BASIN DEVELOPMENT PLANS,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
E. F. Wood.
In: IIASA Conference '76, Volume 2. The International Institute for Applied Systems Analysis, Laxenburg, Austria, p 9-18, 1976. 2 fig, 3 tab, 9 ref.

Descriptors: *Water resources, *River basin development, *Planning, *Multiattribute utility theory, Evaluation, Assessment, Decision making, Systems analysis, Equations, Tisza River basin(Hungary), Scaling factors, Multiobjective, Qualitative preference.

Water resources development planning is a complicated public investment problem, including: multiple conflicting objectives which involve economic, environmental, social, and technical considerations; difficult-to-quantify consequences that are

crucial in selecting an alternative; and uncertainties concerning the overall impact of a particular alternative. In light of these considerations, the IIASA Water Resources group, in conjunction with the Methodology group, initiated a cooperative study with the Hungarian National Water Authority. This study aimed to: investigate the usefulness of multiattribute utility theory for evaluating alternative water resources development plans; and illustrate the technique for planners and decision makers who influence decisions concerning long-range water resources planning. The Tisza River basin, with five alternative development plans studied earlier, was used for the case-study application. This report highlights the IIASA-Hungarian study; a more detailed report can be found listed in the references. In the study, a utility function over 12 objectives was assessed, and preliminary results indicate that building inter-basin water transfers from the Danube River or from small reservoirs in the northeastern part of the basin is to be preferred to developing three other planning alternatives. (See also W79-04686) (Bell-Graf--Cornell)
W79-04688

COMPARISON OF ALTERNATIVE ENGINEERING DESIGNS,
Waterloo Univ. (Ontario). Dept. of Systems Design.
N. M. Znotinas, and K. W. Hipel.
Water Resources Bulletin, Vol. 15, No. 1, p 44-59, February 1979. 1 fig, 12 tab, 6 ref.

Descriptors: *Projects, *Feasibility, *Water resources, *Evaluation, *Sensitivity, *Comparison techniques, Management, Engineering, Design, Decision making, Political aspects, Economic feasibility, North Dakota, Equations, Systems analysis, Mixed aggregation, Alternatives, Quantitative information, Intangible factors, Fuzzy sets, Net benefit.

Procedures are presented for comparing and evaluating alternative engineering designs for a particular water resources project. By using certain aspects of fuzzy set theory, it is possible to introduce both quantitative and qualitative considerations into the decision-making process. In addition, the viewpoints of the various interest groups involved with the water resources development can be realistically incorporated by the evaluation techniques for the alternative designs. Methods are given for eliminating undesirable alternatives and thereby obtaining a reduced set of possible feasible solutions to the problem. Because of the flexibility of the evaluation methods, the viable alternatives should not only satisfy economical, technical, environmental and other types of constraints, but these possible solutions should be politically feasible as well. A method is formulated for checking the sensitivity of the feasible results with respect to the factors that are considered in the analysis. (Bell-Graf--Cornell)
W79-04690

MODIFIED WATER QUANTITY RECEIVING MODEL FOR FLORIDA CONSERVATION AREAS,
South Florida Water Management District, West Palm Beach, FL.
S. T. Lin, and S. F. Shi.
Water Resources Bulletin, Vol. 15, No. 1, p 155-166, February 1979. 5 fig, 10 ref.

Descriptors: *Florida, *Water supply, *Water quantity, *Receiving water, *Monte Carlo method, *Simulation analysis, *Conservation areas, Water storage, Water demand, Runoff, Rainfall, Inflow, Effects, Computer programs, Equations, Backpumping, Hydraulic radius, Roughness coefficient, Dual elevation, Seepage rate, Hypothetical channel, Energy gradient, Flow velocity, Marsh area, Data requirements, Mathematical models, Systems analysis.

The Conservation Areas in South Florida have been considered as one of the major water storage areas to provide a water supply for the Everglades National Park and Lower East Coast (LEC). Due to the increasing water demands of the area, additional backpumping of the surplus runoff from the LEC area into the Conservation Areas has been considered as one of several alternative plans. The Receiving Water Quantity (EPA, 1971) model has been adapted and modified to be applicable in the Conservation Areas to investigate the possible impact of additional inflow under various backpumping cases. The modification of the model has included Manning's roughness coefficient, depth of flow, width of hypothetical channels through marsh areas, rainfall input, seepage rate, etc. The use of the Monte Carlo technique for area computations was found to be easy and time saving both in area and weighting rainfall input to each node. Comparison of results generated by this modified model with the recorded values in Conservation Areas 1 and 2A indicated that the model not only can be a very good evaluation tool to simulate the hydraulic regime of the Conservation Areas system but also a proper tool for investigating the impact of additional inflow resulting from the back pumping related to the water use planning and management. (Bell-Graf--Cornell)
W79-04691

A VIABLE METHODOLOGY TO IMPLEMENT THE PRINCIPLES AND STANDARDS,
Georgia Univ., Athens. Inst. of Natural Resources.
J. Sellers, and R. M. North.
Water Resources Bulletin, Vol. 15, No. 1, p 167-181, February 1979. 1 fig, 2 tab, 24 ref.

Descriptors: *Water resources, *Planning, *Methodology, *Goal programming, *Principles and Standards, Decision making, Projects, Constraints, Analytical techniques, Equations, Mathematical models, Systems analysis, Optimization, Multiple objective, Cross Florida Barge Canal, Economic values, Environmental values, Integration.

The 'principles and standards for planning water and related land resources' were made effective October 25, 1973. The document was noticeably deficient in suggestions for the necessary implementing procedures to insure its success. Current implementing procedures are based on an incorrect premise of maximizing a single objective subject to nonquantified constraints. A successful implementation of multiple objective planning requires optimizing simultaneously several competitive goals. A system of goal programming has been developed and applied to decision-making situations as a test of its usefulness in planning for multiple objective water resources projects. The result is a project planning process which can be replicated for adjustment in expected resource supplies or demands to provide a tradeoff matrix between economic and environmental objectives as well as traditional functional purposes. This procedure, tested on the Cross Florida Barge Canal, is an integrated analysis of economic and environmental values which may be as effective in implementing multiple objective planning as the 'Green Book' was in developing the now inappropriate benefit-cost analysis.
W79-04692

WATER UTILIZATION AND REALLOCATION IN CHILE: A STUDY OF THE PIRQUE VALLEY,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.
L. L. Parks, and D. E. Hansen.
American Journal of Agricultural Economics, Vol. 60, No. 2, p 207-213, May 1978. 1 fig, 2 tab, 8 ref.

Descriptors: *Water utilization, *Water allocation(Policy), *Economic efficiency, *Chile, Farms, Optimization, Linear programming, Methodology, Water supply, Programs, Water law, Mathematical models, Systems analysis, Irrigation distribution, Income distribution.

The 1967 Water Code requires equalization of water rights per hectare in each 'homogeneous farming area.' The analysis of a typical area using linear programming models of representative farms indicates that the equalization of water allocations per unit of land would result in regressive income redistribution, whereas the optimum economic reallocation would result in progressive income redistribution. Aggregate income gains in either case would not exceed 5%. Given the extreme inflexibility of the existing water distribution system, the transaction costs of changing water allocations would probably exceed benefits. (Bell-Graf--Cornell)
W79-04695

ALLOCATION PROCEDURE OF WATER AND LAND RESOURCES IN RELATION TO SOME IRRIGATION QUALITY PARAMETERS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
D. Karmeli.
Water Resources Bulletin, Vol. 14, No. 6, p 1374-1386, December 1978. 1 fig, 3 tab, 5 ref.

Descriptors: *Water resources, *Land resources, *Resource allocation, *Irrigation efficiency, Water costs, Crops, Water supply, Irrigation systems, Equations, Mathematical models, Systems analysis, Estimating, Water-yield functions, Geometric programming, Constraints, Profit maximization.

A procedure is presented for reaching maximal profits from an irrigated farm by optimal allocation of land, water, labor, and capital to the various crops, best irrigation frequency, and level of improvement costs in the irrigation system. The procedure includes the formulation of an objective function based on crop outputs and expenditures. Both outputs and expenditures are adjusted by yield-water-irrigation frequency exponential functions, derived from fits of experimental results. A correction factor for both outputs and expenditures is used to represent levels of irrigation system improvement. The Generalized Geometric Programming method is used to solve the problem of reaching maximal profits from a three-crop farm, subject to constraints. Optimal distribution of land and water, irrigation frequency and optimal level irrigation system improvement are gained for each crop and various sets of market prices. (Bell-Graf--Cornell)
W79-04700

ANALYZING THE IMPACT OF LAND USE ON SEWER SERVICE AREA PLANNING,
Harvard Univ., Cambridge, MA. Dept. of City and Regional Planning.
M. Shapiro, and P. Rogers.
Water Resources Bulletin, Vol. 14, No. 6, p 1340-1356, December 1978. 3 fig, 2 tab, 11 equ, 25 ref.

Descriptors: *Land use, *Effects, *Sewerage, *Planning, *Economics, Optimization, Waste water treatment, Equations, Mathematical models, Systems analysis, Collection systems, Cost functions, Service area analysis, Cost minimization, Sensitivity analysis.

The density and distribution of land uses have important consequences for the planning of sewerage systems and for the costs of these systems. This paper examines these consequences using a simplified service area model which determines the area to be served by a central waste treatment plant, where alternative on-lot disposal systems are also available. The optimization model is applied to various urban area configurations, which are summarized by their total populations and by their population density distributions. Both minimum regional cost and minimum local cost service area configurations are determined. In addition, the sensitivity of the model to the parameters of the cost and population density functions is assessed. It is found that the model is most sensitive to the parameters of the collection cost function. (Bell-Graf--Cornell)
W79-04701

COASTAL ZONE PLAN IMPLEMENTATION,
California Coastal Commission, San Francisco.
E. J. Schoop.
Journal of the Urban Planning and Development Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. UP1, p 37-40, May 1978.

Descriptors: *Beaches, *California, *Shore protection, *State laws, *Access routes, *Recreational facilities, Government agencies, Planning, Coastal engineering, Conservation, Urban development.

The California Coastal act of 1976 is designed to enhance public access and recreation, the marine environment, and coastal land resources by requiring development to be compatible with those objectives. A permanent Coastal Commission is established to control development through permits while working with local governments to revise their plans and ordinances in accordance with the Coastal Act. Upon satisfactory completion of local government plans and ordinances by 1981, most of the management of California's coastal zone is expected to be in the hands of local government, but the Coastal Commission will continue in effect to review appeals from improper local government decisions and to review and approve amendments to local plans as may be necessary in the future. (Bell-Graf--Cornell)
W79-04709

REGIONAL WATER SUPPLY PLANNING STUDY FOR NORTHEASTERN ILLINOIS,
Keifer and Associates, Inc., Chicago, IL.
C. J. Keifer, D. E. Westfall, D. A. Fagan, and F. C. Neal.
Water Resources Bulletin, Vol. 15, No. 1, p 17-29, February 1979. 3 fig, 8 ref.

Descriptors: *Water supply, *Long-term planning, *Regional development, *Lake Michigan, *Water allocation(Policy), *Optimum development plans, Computer models, Illinois, Water utilization, Great Lakes, Diversion, Water policy, Water levels, Digital computers, Runoff, Watersheds(Basins), Rivers, Chicago(Ill), Cost-effectiveness, Source analysis, Systems analysis.

The development of a regional water supply system for the six-county area of Northeastern Illinois is presented herein, including: (1) the establishment of regional water supply technical planning policies; (2) the development and utilization of a regional water supply computer model to identify the principal and secondary sources of water supply for each entity in the study area, based on an apparent cost-effective source analysis; and (3) the utilization of the study results to develop for the year 2010 a suggested preliminary regional water supply system. The primary objectives of the computer model are: (1) to identify those sources of public water supply that minimize the total annual costs to construct, operate and finance a regional water supply system in the study area; and (2) to compute the unit cost of water supply for each entity. Using the findings from task 2 above, a proposed plan for overall Lake Michigan water use through 2010 is also developed. The effects of the proposed regional water supply system on future water levels in the deep aquifer are also discussed. (Bell-Graf-Cornell)
W79-04717

CRITICAL REVIEW OF ESTIMATING BENEFITS OF AIR AND WATER POLLUTION CONTROL,
Environment Control, Inc., Rockville, MD.
For primary bibliographic entry see Field 6B.
W79-04762

FLOOD-PLAIN DELINEATION FOR HORSEPEN RUN, SUGARLAND RUN, NICHOLS RUN, AND POND BRANCH BASINS, FAIRFAX COUNTY, VIRGINIA,
Geological Survey, Richmond, VA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W79-04801

PREDICTIVE ANALYSES OF GROUNDWATER DISCHARGES IN THE WILLOW CREEK WATERSHED, NORTHEAST NEBRASKA,
Geological Survey, Lincoln, NE. Water Resources Div.
J. T. Dugan, and E. G. Lappala.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 552, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-67, July 1978. 66 p, 22 fig, 7 tab, 20 ref.

Descriptors: *Surface-groundwater relationships, *Computer models, *Base flow, *Forecasting, *Hydrogeology, Groundwater movement, Groundwater recharge, Hydrologic budget, Irrigation, Climatic data, Nebraska, *Willow Creek watershed.

Ground-water discharge to Willow Creek in northeast Nebraska was predicted with a digital model of the ground-water/surface-water system. Recharge and irrigation requirements were determined with a model of the soil zone. The regional aquifer is Pliocene and Pleistocene sands and gravels. Water in the regional aquifer is unconfined in the western part of the watershed and confined in the eastern part. The confining layer is Pleistocene eolian silts with very fine sand interbeds overlying a basal clay. Where the regional aquifer is unconfined, perennial flow of Willow Creek is sustained by ground-water discharge. Where it is confined, the low hydraulic conductivity of the confining beds isolates the regional aquifer from Willow Creek. Adequate agreement between simulated and observed streamflows and water levels during 1975 and 1976 was obtained by modifying initial estimates of hydraulic conductivity and specific storage. The future perennial flow of Willow Creek was simulated by superimposing six patterns of ground-water withdrawals upon variations in recharge for a monthly climatic sequence identical with the period 1931-34. These analyses showed that the perennial monthly flows would be less than 12 cubic feet per second at least 50 percent of the time. (Woodard-USGS)
W79-04805

ASSESSMENT TECHNIQUES FOR MODELING WATER QUALITY IN A RIVER BASIN AFFECTED BY COAL-RESOURCE DEVELOPMENT,
Geological Survey, Lakewood, CO. Water Resources Div.
T. D. Steele.
Paper presented at: Symposium on Modeling the Water Quality of the Hydrological Cycle, International Association of Hydrological Sciences and International Institute for Applied Systems Analysis, Baden, Austria, September 11-15, 1978. 16 p, 6 fig, 1 tab, 22 ref.

Descriptors: *Coal mine wastes, *Path of pollutants, *Projections, *Model studies, *River basins, Colorado, Wyoming, Surface waters, Groundwater, Regional analysis, Hydrologic data, Simulation analysis, Water quality, Streamflow, Aquifers, Mathematical models, Land use, Water demand, Planning, Evaluation, *Yampa River basin.

A regional water-resources assessment in the Yampa River basin, Colorado and Wyoming, used modeling techniques applied in five component studies to evaluate direct and indirect impacts of coal-resource development. Modeling of the waste-load assimilative capacity of the Yampa River indicated exceedence of a proposed standard for nonionized ammonia concentration using assumptions of anticipated population growth and treatment-plant effluents. Traveltimes for a 50-kilometer reach of the Yampa River ranged from 15.7 hours for seasonal high flow of 28 cubic meters per second to 120 hours for a low flow of 0.8 cubic meter per second; measured reaeration coefficients for selected subreaches ranged from 6.04 to 33.4 per day. Modeling of alternative configurations of proposed reservoirs indicated a reduction of annual time-weighted dissolved-solids concentrations downstream by an estimated 34 percent. By 1990, an increase of between 9 and 27 thousand metric tons of sediment derived from surface-mined areas is estimated to be transported annually in basin streams. Model simulations of a hypothetical 5,000 milligrams per liter conservative contaminant predicted its direction, rate, and dispersion in one of the major coal-bearing aquifers during a 200-year period. The benefits of integrating physically based modeling components for assessing regional water-resources management alternatives are demonstrated. (Woodard-USGS)
W79-04808

COMPUTER MODEL OF TWO-DIMENSIONAL SOLUTE TRANSPORT AND DISPERSION IN GROUND WATER,
Geological Survey, Reston, VA. Water Resources Div.
L. F. Konikov, and J. D. Bredehoeft.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $2.75. Geological Survey Techniques of Water-Resources Investigations, Book 7, Chapter C2, 1978. 90 p, 19 fig, 5 tab, 15 ref.

Descriptors: *Computer models, *Groundwater, *Subsurface flow, *Path of pollutants, Analytical techniques, Simulation analysis, Equations, Solutes, Dispersion, Groundwater movement, Transmissivity, Groundwater recharge, Water wells, Pumping, Hydrogeology, Solute transport, Particle tracking.

Solute transport in flowing ground water can be simulated with a model that couples the groundwater flow equation with the solute-transport equation. This report documents a digital computer program that uses an alternating-direction implicit procedure to solve a finite-difference approximation to the ground-water flow equation and the method of characteristics to solve the solute-transport equation. The latter uses a particle tracking procedure to represent convective transport and a two-step explicit procedure to solve a finite-difference equation that describes the effects of hydrodynamic dispersion, fluid sources and sinks, and divergence of velocity. The model is both general and flexible in that it can be applied to a wide range of problem types. The program allows the specifications of any number of pumping wells, up to five observation wells, and spatially varying recharge, transmissivity, thickness, boundary conditions, and initial conditions. Mass balance errors will generally be less than 10 percent. (Woodard-USGS)
W79-04813

PREDICTING AND SIMULATING PESTICIDE TRANSPORT FROM AGRICULTURAL LAND: MATHEMATICAL MODEL DEVELOPMENT AND TESTING,
Environmental Research Lab., Athens, GA.
For primary bibliographic entry see Field 5B.
W79-04920

MATHEMATICAL METHODS FOR ANALYSIS OF FRESH WATER LENSES IN THE COASTAL ZONES OF THE FLORIDAN AQUIFER,
Florida Univ., Gainesville. Water Resources Research Center.
For primary bibliographic entry see Field 4B.
W79-04961

A POLICY-ORIENTED SIMULATION MODEL OF DEBRIS PRODUCTION FROM A CHAPARRAL-COVERED WATERSHED,
Wisconsin Univ.-Madison. Dept. of Forestry.
T. M. Bonnicksen.
In: Proceedings of the Symposium on the Environmental Consequences of Fire and Fuel Management in Mediterranean Ecosystems, August, 1977. USDA Forest Service General Technical Report WO-3, p 431-442, 5 fig. (CA. Water Resources Center Project UCAL-WRC-W-499). OWRT-A-058-CAL(3).

Descriptors: *Fire, *Forest management, *Computer models, *Brushlands, *Model studies, Fuels, Burning, Forest fires, Brush control.

A policy-oriented computer simulation model was developed for estimating the cumulative volume of debris produced, in cu. yds./sq. mi., from 0.1 square mile watersheds along the southern flank of the Central San Gabriel Mountains. The model

was constructed with a mathematical expectation formula that uses input data computed from equations fitted to nomogram curves from Ferrell's (1959) Report on Debris Reduction Studies for Mountain Watersheds. The computer model was used to evaluate the physical consequences associated with applying different fire management policies to these watersheds, including leaving them unburned, burning them on 15- and 25- year rotations and allowing each watershed to be burned in its entirety once in 50 years, and once every 20 years. The political implications of the simulation results were evaluated with a conceptual model that uses the resources people claim to link interest-groups to particular successional stages in brushland watersheds. (Snyder, Calif.-Davis)
W79-04967

6B. Evaluation Process

OIL SHALE AND THE ENVIRONMENT,
Environmental Protection Agency, Washington, DC.
D. Myers, P. Dorset, and T. Parker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 617, Price codes: A03 in paper copy, A01 in microfiche. EPA-600/9-77-033, October 1977. 29 p, 6 ref.

Descriptors: *Oil shale, *Environmental effects, *Water pollution sources, *Air pollution, *Energy, *Resources development, Colorado, Wyoming, Utah, Green River Formation, Boom-towns, Planning, Research and development, Natural resources, Oil, Oil industry, Federal government, Piceance Basin(CO), Urbanization, Public health, Solid wastes, Fossil fuels.

The oil-shale extraction process, extent of the resource, and environmental dangers are discussed. Research and development are now underway to reduce uncertainties of oil shale production costs, sources of capital, competition from other oil sources and other energy sources, and environmental costs. Most of the oil shale (and the most valuable part) is found largely on federal land in the Green River Formation of Colorado's Piceance Basin (85% of western high grade shale), Utah's Uintah Basin (10%), and in Wyoming (5%). An estimated 80 billion barrels of oil can be recovered using current technology, and 800 billion barrels may ultimately be recovered. The oil is extracted through heating, which breaks the chemical network and cracks the heavy kerogen molecules into smaller molecules. This releases the valuable liquid hydrocarbon mixture, combustible gases, and a coke-like residue. Recovery of one barrel of shale oil uses 2-6 barrels of water, 1-2 tons oil shale, and 100 sq ft of land and produces .33 lb airborne dust, 2.5 lbs polluting gases, 2-5 gal contaminated water, and 1-1.5 tons spent shale. A one-million bbl/day operation, including towns, will occupy about 80,000 acres of land. Direct effects include land and habitat disruption, dust and gas air pollution (currently exceeding federal and state standards), surface and groundwater depletion, increased river salinity, and possible water pollution. (Lynch-Wisconsin)
W79-04522

ECONOMIC AND ENERGY ANALYSES OF REGIONAL WATER POLLUTION CONTROL,
Oregon State Univ., Corvallis. Water Resources Research Inst.
R. J. Heggen, and K. J. Williamson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 098, Price codes: A09 in paper copy, A01 in microfiche. EPA-600/5-78-019, September 1978. 163 p, 24 fig, 17 tab, 93 ref, 10 append. 68-03-2397.

Descriptors: *Water pollution control, *Willamette River Basin(OR), *Energy, *Flow augmentation, *Waste water treatment, *Analytical techniques, *Mathematical models, Regional economics, Regional planning, Planning, Oregon, River basins, Reservoirs, Econometrics, Input-output analysis, Water management(Applied), Model studies, Economics, Dissolved oxygen, Simulation analysis, Industrial wastes, Costs, Alternative planning.

Successful restoration of the Willamette River Basin (Oregon) since the 1950s through wastewater treatment and flow augmentation is used as a case study for retrospective comparison of alternative pollution control methods, focusing on competing demands of the environment, the economy, and energy conservation. Input/output analysis and a dissolved oxygen model shows that: (1) While restoration of dissolved oxygen in the Willamette was in harmony with environmental policies, and resulted in an economic advantage to the basin, summer DO was purchased with fossil fuels needed for long-term economic growth. (2) Savings of $2-4 million annually might have been realized if flow augmentation (which dilutes polluted wastewater) had been increased and treatment decreased. (3) Water quality control cost an estimated $33 million in 1973. (4) In 1973, 510 TJ (terajoule) of direct energy were consumed for pollution control. (5) That year, 1373 primary TJ were required to directly support pollution regulation. (6) Treatment plant construction typically used 0.8 times as many direct joules per dollar as reservoir construction, but 1.4 times as many primary joules. (7) Treatment plant operation, maintenance, and replacement (OMR) used 3.2 times as much direct energy per dollar as did reservoir OMR. Three pollution control methods were simulated: (1) current enforcement and augmentation, (2) less augmentation and increased treatment, and (3) increased augmentation and reduced treatment. (Lynch-Wisconsin)
W79-04523

ASSESSMENT OF BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE FOR SYNTHETIC RUBBER MANUFACTURING WASTEWATER,
Abcor Inc., Wilmington, MA. Walden Div.
M. H. Kleper, A. Z. Gollan, R. L. Goldsmith, and K. J. McNulty.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 402, Price codes: A03 in paper copy, A01 in microfiche. EPA-600/2-78-192, August 1978. 181 p, 55 fig, 52 tab, 12 ref, 2 append. 68-03-2341.

Descriptors: *Synthetic rubber, *Industrial water treatment, *Best available technology economically achievable, *Water pollution control, *Water quality standards, Federal Water Pollution Control Act Amendments of 1972, Regulation, Technology, Emulsion crumb rubber, Solution crumb rubber, Latex, Effluents, Effluent limitations, Dual-media depth filtration, Ultrafiltration, Activated carbon adsorption, Reverse osmosis, Ozonation.

Best Available Technology Economically Achievable (BATEA) for wastewater treatment, required by the Federal Water Pollution Control Act Amendments for 1972 for implementation by 1983, is assessed for the synthetic rubber manufacturing industry, categorized by three processes: (1) emulsion crumb rubber, (2) solution crumb rubber, and (3) latex rubber. Technologies recommended also require on-site field tests for a demonstration of their BATEA capabilities. Assessment was based on feasibility tests with actual wastewater samples, both end-of-pipe (untreated) and after primary and secondary treatment. Treatment processes examined included: dual-media depth filtration (DMDF) and ultrafiltration (UF) for suspended solids removal; activated carbon adsorption (ACA), reverse osmosis (RO), and ozonation for removal of dissolved contaminants; and ozonation as a polishing step after RO or ACA for removal for refractory organics. Preferred options are: (1) for emulsion crumb rubber, the proposed BATEA sequence of DMDF and ACA for treatment of effluents from primary/secondary treatment; (2) for solution crumb rubber, the proposed sequence for existing sources with primary/secondary systems currently installed, and for new sources, treatment of end-of-pipe wastewaters by UF and RO with possible water reuse as an alternative to the proposed sequence; and (3) for latex rubber, UF for treatment of tank and tank car washdown streams, with treatment of UF product water and the remaining 10-30% of wastewater flow by biological treatment. (Lynch-Wisconsin)
W79-04525

ENGINEERING AND ECONOMIC ANALYSIS OF WASTE TO ENERGY SYSTEMS,
Parson (Ralph M.) Co., Pasadena, CA.
E. M. Wilson, J. M. Leavens, N. W. Snyder, J. J. Brehany, and R. F. Whitman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-285 797, Price codes: A20 in paper copy, A01 in microfiche. Report No. EPA-600/7-78-086, May 1978. 264 p, 47 fig, 58 tab, 19 ref, 5 append. EHE 624B, 68-02-2101.

Descriptors: *Engineering, *Economics, *Beneficial use, *Solid wastes, *Energy, *Pyrolysis, *Fuels, *Waste disposal, *Costs, Water pollution sources, Wastes, Waste water disposal, RESGO-Saugus combustion system, Hamilton, Ontario waterwall, Incinerator, Nashville Thermal Transfer Corporation, Chicago-Commonwealth Edison Supplementary Fuel Plant, Georgia Institute of Technology Mobile Agricultural Pyrolysis System, ANDCO-Torrax Air Blown Pyrolysis System, Union Carbide Corporation Oxygen Blown Pyrolysis System, Occidental Research Corporation Flash Pyrolysis System.

Various systems for converting solid wastes (exclusive of mining wastes) to energy are evaluated. Technology is reviewed under four categories: (1) mechanical processing, (2) biological conversion systems, (3) thermal/chemical systems, and (4) combustion. Detailed engineering and economic analysis of seven systems are presented: (1) mass burning combustion systems of RESGO-Saugus and Hamilton, Ontario; (2) Nashville Thermal Transfer Corporation; (3) Chicago-Commonwealth Edison Supplementary Fuel Plant; (4) Georgia Institute of Technology Mobile Pyrolysis System; (5) ANDCO-Torrax Air Blown Pyrolysis System; (6) Union Carbide Purox Pyrolysis System; and (7) Occidental Research Corporation Flash Pyrolysis System. Technology and costs for converting pyrolytic off-gas to methane, methanol, and ammonia is also analyzed. Although some facilities can convert wastes to energy economically there is little information on environmental emissions and effects from the plants, and on physical, chemical, and combustion characteristics of refuse-derived fuels. More research is needed to identify the best equipment for handling and processing solid wastes (most exciting systems were adapted from nonsolid-waste systems), and to develop fundamental information on pyrolysis chemistry. Detailed assessments are given of each of the systems investigated, and environmental pollution data are presented where available. (Lynch-Wisconsin)
W79-04526

ESTIMATING COSTS FOR WATER TREATMENT AS A FUNCTION OF SIZE AND TREATMENT PLANT EFFICIENCY,
Culp, Wesner, Culp, Santa Ana, CA.
R. C. Gumerman, R. L. Culp, and S. P. Hansen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-285 274, Price codes: A13 in paper copy, A01 in microfiche. EPA-600/2-78-182, August 1978. 282 p, 103 fig, 98 tab, 2 append. CI-76-0288.

Descriptors: *Treatment facilities, *Estimated costs, Size, Efficiencies, *Municipal water, *Water treatment, Costs, Economics, Construction costs, Technology, Operation and maintenance, Potable water, Regulation, National Interim Primary Drinking Water Regulations, Environmental Protection Agency, Water quality standards, Safe Drinking Water Act, Pollutants, Water pollution control, Water purification, Water supply.

Construction, operation and maintenance cost curves are given for 30 municipal water treatment unit processes which individually or in combination are especially applicable for removal of contaminants included in the National Interim Primary Drinking Water Regulations, promulgated by EPA in 1975-76 under the Safe Drinking Water Act of

1974. The final report will include cost curves for over 100 unit processes. For each unit process, conceptual designs were formulated and construction costs developed in tabular format according to eight categories; (1) excavation and sitework, (2) manufactured equipment, (3) concrete, (4) steel, (5) labor, (6) pipe and valves, (7) electrical and instrumentation, and (8) housing. Operation and maintenance requirements were determined individually for energy, maintenance material, and labor. Energy requirements were determined separately for building and process requirements. All costs are as of January 1978. For construction cost updating two methods may be used; (1) use of indices specific to the eight categories, and (2) use of an overall measure such as the ENR Construction Cost Index. Operation and maintenance requirements may be updated readily or adjusted to local conditions, since labor requirements are expressed in hrs/yr and electrical requirements in kilowatt-hrs/yr. A list is given of the most effective treatment methods for 17 contaminants. (Lynch-Wisconsin)
W79-04527

AN ANALYTICAL MODEL FOR ESTABLISHING WATER RESOURCES DEVELOPMENT PRIORITIES,
Oklahoma Univ., Norman. Bureau of Water and Environmental Resources Research.
W. Reid, and W. K. Leung.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 562, Price codes: A07 in paper copy, A01 in microfiche. Oklahoma Water Resources Reseach Institute, Oklahoma State University, Stillwater. Technical Completion Report, September, 1978. 125 p, 24 fig, 1 tab, 51 ref, append. OWRT A-072-OKLA(1).

Descriptors: *Priorities, Impoundments, Groundwater, *Delphi method, Political aspects, Project feasibility.

A priority analysis procedure for ranking water resources development project is presented. The procedure is based on a scoring model approach that evaluates water resources development projects in terms of as many as eighteen parameters. It recognizes needs and deficiencies and also incorporates the following features: socio-economic impacts, environmental effects, continuity, and local political reactions. The Delphi technique is used to determine the weights of the individual parameters. For each project, the individual parameters are evaluated and combined through a set of weighting factors into one or two indices that can then be used to rank the projects. The water resources development projects are categorized according to three functional groups, i.e., water treatment facilities, impoundment systems, and groundwater. The projects are ranked within each category.
W79-04586

THE DEVELOPMENT OF A COMBINED WATER QUALITY INDEX,
Arizona Univ., Tucson. School of Renewable Natural Resources.
J. K. Yu, and M. M. Fogel.
Water Resources Bulletin, Vol. 14, No. 5, p 1239-1250, October 1978. 3 fig, 27 ref. OWRT-B-043-ARIZ(29), 14-31-0001-5056.

Descriptors: *Water quality index, *Cost-benefit analysis, *Economic model, Waste water treatment, Pollutants, Methodology, Optimization, Water supply, Irrigation, Recreation, Waste disposal, Decision making, Estimating, Industrial use, Equations, Systems analysis.

Use-oriented benefits and treatment costs analysis has been incorporated into a water quality index to show an economically optimized concentration for the treatment of the pollutants and the resulting water quality. This combined water quality index can be used in decision making at the federal and local government levels. Five major tants, i.e., coliforms, nitrogen, phosphorus, suspended solids, and detergent, have been considered for the municipal waste water. With each higher level of improvement, the treatment costs increase accordingly and the benefits associated with the reuse of this treated waste water will increase also, but not for the nutrient removal in agricultural use. The optimal concentration is determined when the marginal costs equal the margninal benefits. The combined water quality index is the combination of the maximum net benefits and the water quality index of the optimized residual concentrations. This water quality index is zero dollars for the Tucson region in this study. The possible reclaimed use of municipal waste water is for agricultural irrigation and recreational lakes for the Tucson region. (Bell-Cornell)
W79-04610

ECONOMIC VALUATION OF SHORELINE,
G. M. Brown, Jr., and H. O. Pollakowski.
Review of Economics and Statistics, Vol. 59, No. 3, August 1977. p 272-278, 1 fig, 2 tab, 22 ref. OWRT A-072-WASH(2). 14-31-0001-5048.

Descriptors: Economics, *Value, *Shores, Land development, Public policy, Optimization, Land use, Washington, Costs, Prices, Cost-benefit analysis, Property values, Decision making, Social values.

The economic significance of undeveloped shoreline is investigated in the light of three questions: (1) Is the urban land market likely to provide a solution which is Pareto efficient. (2) Are zoning and other building restrictions socially optimal. (3) What contributions can be made by studies of the determinants of property values. The analysis examines: (1) criteria of housing quality attributes taken under consideration by a metropolitan household, such as waterfront open space and proximity to the water; (2) the process and estimation of implicit price formation, employing data on individual dwelling units in a metropolitan area with numerous bodies of water (Seattle, Washington); and (3) inferences from these results about the demand for open space and the welfare gains or losses from changes in the amount of open space. Property values fall with distance from the water, as does marginal cost of property exchanged in a competitive market. Since average cost is greater than marginal cost, an entrepreneur seeking optimal open space cannot cover costs by setting price equal to marginal cost of open space for all beneficiaries. The entrepreneur must either be permitted to deviate from marginal cost pricing or receive a subsidy. The other solution is for the public sector to provide open space through direct action. With falling marginal costs of acquiring open space, it must be calculated whether total benefits of open space are greater than total costs. (Lynch-Wisconsin)
W79-04620

EXPRESSION AND REPRESSION OF SPECIAL INTERESTS IN PLANNING AND MANAGEMENT OF THE MERAMEC PARK RESERVOIR,
Missouri Water Resources Center, Columbia.
J. A. Hartman, and H. F. Lionberger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 679, Price codes: A05 in paper copy, A01 in microfiche. Completion Report, February 1979. 77p, 2 fig, 9 tab, 17 ref, 3 append. OWRT-A-084-MO(1), 14-31-0001-5025.

Descriptors: Planning, Q-Methodology, Reservoirs, *Public participation, Meramec Dam, Social aspects.

A study was made of how people become involved in a controversy, such as the Meramec Dam, and how they structure their opinion positions. The universe of unit ideas which people use to structure their opinions, and the presence of patterns related to sociologically identifiable variables within the social context of the controversy were determined. In the first phase the ideas used in expressing opinions were studied. A second portion included a survey approach in a carefully selected sample of persons -- Q-Methodology. The results show in depth the background thinking, and reasons for participation of both the Pro-Dam and the Anti-Development respondents. (Smith-Missouri)
W79-04647

OPTIMAL IRRIGATION MANAGEMENT STRATEGY UNDER HYDROLOGIC AND IRRIGATION EFFICIENCY UNCERTAINTY REGIMES,
Idaho Univ., Moscow.
For primary bibliographic entry see Field 3F.
W79-04685

MULTISOURCE/MULTIQUALITY AGRICULTURAL WATER USE DECISIONMAKING,
Office of Surface Mining Reclamation and Enforcement (DI), Washington, DC. Branch of Environmental Analysis.
For primary bibliographic entry see Field 3C.
W79-04693

BENEFITS AND COSTS OF WATER QUALITY IMPROVEMENTS,
Environmental Protection Agency, Dallas, TX. Region VI.
E. A. Jeffrey, and J. E. Singley.
Journal of the American Water Works Association, Vol. 70, No. 12, December 1978. 9 ref.

Descriptors: *Cost-benefit ratio, *Water quality control, *Improvement programs, Mathematical models, Estimating, Systems analysis, Decision making, Contaminants, Waterborne diseases, Health benefits, Uncertainties.

A modeling approach is described for estimating benefit-cost ratios for water quality improvement programs. A model is developed for three waterborne diseases to illustrate the feasibility of the approach, which can be used for contaminants other than biological factors. Although both benefits and costs are necessarily estimates, the model lends perspective to and indicates trends for estimating the cost of a water quality improvement as opposed to its health benefits. (Bell-Graf--Cornell)
W79-04699

A PROPOSED METHOD OF EVALUATING FLOOD DAMAGES TO HISTORIC HOMES--AN EXTERNALITY APPROACH,
Army Engineer District, St. Louis, MO.
R. Rodakowski.
Water Resources Bulletin, Vol. 14, No. 6, p 1295-1303, December 1978. 4 fig, 1 tab, 11 ref.

Descriptors: *Flood damage, *Evaluation, *Methodology, *Historic homes, *Depth-damage curves, *Replication, Externality, Demand, Supply, Costs, Probability, Systems analysis.

Traditional procedures for evaluating flood damages to residential dwellings do not reflect intrinsic values when applied to historic homes. Such structures are worth more than that determined by using depth-damage curves provided by insurance companies who assess damage values based upon current labor and material costs. The evaluation of the worth of an historic home and subsequent damages due to inundation can be regarded as a problem of externalities. An assessment technique reflecting historic amenities or what has been termed replication cost is proposed herein. Replication costs would have widespread use not only in solving flood damage problems, but also in any study where historic entities are subject to damages from catastrophies such as hurricanes, soil and beach erosion, and increasing urbanization. If adopted as a technique, it would enhance and preserve the ever-decreasing enclaves of historic homes and neighborhoods. (Bell-Cornell)
W79-04702

ECONOMIC PERFORMANCE OF RESERVOIRS A SENSITIVITY ANALYSIS,
New South Wales Univ., Kensington (Australia).
B. A. Cornish.
Report No. 152, Water Research Laboratory, The

University of New South Wales, Manly Vale, N.S.W., Australia, April 1978. 148 p, 39 fig, 19 tab, 19 ref.

Descriptors: *Water resources, *Reservoirs, *Performance, *Cost-benefit analysis, *Simulation analysis, *Stochastic processes, *Reliability, Estimating, Optimization, Mathematical models, Equations, Systems analysis, Reservoir storage, Flow, Statistical methods, Behavior, Benefit maximization, Sensitivity analysis.

Investigated is the precision with which it is necessary to estimate various parameters of a single reservoir water resource system to achieve any specified accuracy in estimating the returns, and the possible variability of economic returns, which could result from the operation of a single reservoir system; considered as well are developing procedures for determining the optimum development level for the use of water supplied by the system to maximize the mean of the present worth of the return. This study has been carried out using computer simulation of the behavior of a single reservoir on a river in which flow is stochastic. The reservoir is assumed to supply water for a use giving a mometary return. Instead of concentrating on the asymptotic or long-run behavior of reservoirs, the study expresses its results in terms of transient behavior. It is shown that, for each system, there is an optimum demand which maximizes the mean of the present worth of the return from the system, and which is not greatly affected by the life of the system, by the discount rate or by the capacity of the reservoir, but is mainly affected by the mean, the standard deviation and the coefficient of skewness of the inflow into the system. (Bell-Graf--Cornell)
W79-04711

QUALITY CONSIDERATIONS FOR WATER SUPPLY EVALUATIONS,
Engineering-Science, Inc., Arcadia, CA.
D. V. MacDonald, K. P. Barney, Jr., and R. A. Smith.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. EE2, p 245-258, April 1978. 6 fig, 7 ref.

Descriptors: *Water supply, *Water quality, *Costs, *Crop production, *Consumer acceptance, Dissolved solids, Leaching, Salt tolerance, Crop yield, Benefits, Mineral content, Ventura County(CA.), Regional analysis, Southwest U.S., Evaluation, Agriculture, Methodology.

In regions where the water quality of the sources can vary, the beneficial effects of the higher quality water should be considered. This is particularly true in the Southwestern United States where the mineral content of the water can vary among the various sources such as local ground water, local surface water, and imported water. This paper describes a procedure that was used in a water supply study in Ventura County, California. The study involved the evaluation of several sources of water having varying mineral contents. The procedure used considers the additional consumer costs for high mineral content water for both the domestic and industrial user. The procedure also develops the agricultural benefit costs for the lower water requirements and the higher crop yields associated with lower mineral content water. The total project costs of an alternative should be adjusted by the proper benefit cost accrued through the use of a high quality water. (Bell-Cornell)
W79-04714

ECONOMIC ISSUES RELATED TO LARGE-SCALE WATER TRANSFERS IN THE USA,
Colorado Univ., Boulder. Dept. of Economics.
For primary bibliographic entry see Field 6D.
W79-04759

SOCIAL AND ECONOMIC ASPECTS OF WATER EXPLOITATION,
C. Widstrand.
Water Supply and Management, Vol. 2, No. 4, p 279-282, 1978.

Descriptors: *Social aspects, *Irrigation, *Potable water, *Water supply, *India, *Africa, Economics, Public benefits, Public health, Human diseases, Administration, Water allocation(Policy), Water management(Applied), Social participation, Political constraints, Governments, Planning, Water supply development.

Economic and social aspects of Indian subcontinent irrigation programs and East African rural drinking water projects are discussed. Expected social benefits from clean drinking water supplies in the latter area over the last decade have not been realized, and a century of large-scale irrigation works on the Indian subcontinent have created numerous problems. None of these projects have met expectations and most facilities are used to only 50% of capacity. Health improvements from the drinking water schemes have been limited by: (1) fecal or other contamination of the new water supplies, (2) failure to use the new sources during the wet season when closer water sources may be available, (3) bias in favor of pumps or lack of water pressure. Provision of water supplies has been the domain of engineers, with little input from economists and none from social scientists, and questions of operation and maintenance were neglected. Planning was accomplished without local participation or consideration of the needs of the people affected. Two notable problems accompany irrigation projects: (1) outbreak of such diseases as malaria and schistosomiasis, and (2) the conflict between water availability and allocation according to real needs. Failure to resolve the allocation problem will make water an important factor in the distribution of economic and political power. (Lynch-Wisconsin)
W79-04760

CONSTRUCTION COSTS FOR MUNICIPAL WASTEWATER CONVEYANCE SYSTEMS: 1973-1977.
Dames and Moore, Denver, CO.
U.S. Environmental Protection Agency, Technical Report No EPA 430/9-77-014, MCD-38, May 1978. 180 p, 3 fig, 23 tab, 4 append.

Descriptors: *Construction costs, *Sewerage, *Conveyance structures, *Waste water(Pollution), *Pipes, *Construction grants program, *Public participation, Environmental Protection Agency, Grants, Financing, Municipal wastes, Estimated costs, Estimating, Costs, Economics, Sewers, Domestic wastes, Waste water conveyance, Manholes, Social participation, Federal Water Pollution Control Act Amendments of 1972, Citizen participation.

Construction bid data for municipal wastewater conveyance systems from all 10 U.S. Environmental Protection Agency regional offices provide a nationwide reference for estimating future facilities costs. A method is also described which enables citizens to estimate the cost and tax burden of a proposed sewer system. All 455 facilities were municipally owned systems funded under the Federal Water Pollution Control Act Amendments of 1972. Costs for collector and interceptor projects and for associated pump stations and force mains were included, but costs for cast-in-place sanitary sewer pipes were not available. In addition, costs for grant allotment Step I (facility planning, cost-effectiveness analysis, and preliminary sewer design), Step II (detailed plans and specifications), and the nonconstruction portion of Step III (construction phase) were collected and analyzed, but costs of treatment facilities were not included. Costs cover labor and materials per foot of sewer in place, in 1977-78 values. Costs for manholes, pipe casing, and special bedding are given both in totals and itemized. The EPA intends to update cost data on a regular basis. The EPA and U.S. Army Corps of Engineers are refining the CAPDET model for the design and evaluation of wastewater treatment systems to allow estimation of conveyance costs. (Lynch-Wisconsin)
W79-04761

CRITICAL REVIEW OF ESTIMATING BENEFITS OF AIR AND WATER POLLUTION CONTROL,
Environment Control, Inc., Rockville, MD.
A. Hershaft, A. M. Freeman, III, T. D. Crocker, and J. B. Stevens.
Report No EPA-600/5-78-014, June 1978. 1HA094. 68-01-2821.

Descriptors: *Air pollution, *Water pollution control, *Benefits, *Economics, *Welfare(Economics), *Cost-benefits analysis, *Pollution abatement, *Methodology, Alternative planning, Planning, Policy, Water pollution effects, Air pollution effects, Model studies, Mathematical models, Recreation demand, Willingness to pay, Social values, Research priorities, Public benefits, Environmental Protection Agency, Estimating, Monitoring, Public health, Property values, Damage functions, Social aspects, Evaluation, Analytical techniques.

Individually authored critiques of methodologies for estimating benefits cover pollution control in general, air pollution control, and water pollution control. Though the conceptual basis provided by economic theory for benefit estimation is adequate in most respects, empirical data are insufficient. Several studies fail to explicitly list critical assumptions or to adequately express certainty in results, and some have used inappropriate conceptual models. Damage functions underlying benefit estimates frequently are based on insufficient data or poor characterization of exposure and effects, and many national benefits estimates are derived from regional studies not intended for such extrapolation. Recommendations: (1) funding for benefits estimation research should be increased; (2) a comprehensive national plan for coordinated regional benefit studies should be developed; and (3) benefits of past and current pollution control programs should be evaluated. The primary problem in assessing water pollution control benefits is a lack of generalizable behavioral relationships between water quality and consumer behavior, and thus willingness to pay for improvements. This report was partly based on a two-day conference on benefits estimation. (Lynch-Wisconsin)
W79-04762

WATER-ORIENTED OUTDOOR RECREATION IN THE ILLINOIS RIVER BASIN (APPENDIX VI)--ILLINOIS-INDIANA-WISCONSIN.
Bureau of Outdoor Recreation, Philadelphia, PA. Northeast Regional Office.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 296, Price codes: A08 in paper copy, A01 in microfiche. Sponsored by U. S. Dept. of Health, Education, and Welfare, Public Health Service, Region V, June 1964, 158 p, 2 tab, 1 appendix, 1 map.

Descriptors: *Water quality, *Water resources development, *Recreation, *Recreation demand, *Illinois River Basin, *Illinois, Public health, Water utilization, Regional planning, Water pollution, Water transportation, Data collection, Land use, Outdoor recreation, Water quality standards, Indiana, Wisconsin.

The demands for water-based recreation activities are expected to increase in the next few decades. However, as the demand for water recreation opportunities grows, the number of suitable water areas declines and competition for available areas increases. The water recreation situation in the Illinois River Basin is worsening because demand is increasing faster than supply. The purposes of this report are: (1) to evaluate existing water recreation opportunities in the Illinois River Basin and its zone of influence; (2) to determine furture needs for recreation areas and facilities; (3) to identify potential recreation areas; and (4) to recommend actions or programs to improve the Basin's water recreation opportunities, both new and in the future. The Illinois River Basin comprises more than 44,000 square miles, 85% of which is located in Illinois, and whose population is 85% urban. The major problem in meeting demand for water-based recreation is water pollution. The report lists all present and potential water-based recreation

sites, their acreage, location, water quality, and types of activities possible at the sites. An extensive list of suggested actions to meet this future demand and government programs relating to water-based recreation development is present. (Coan-NC)
W79-04853

WATER MANAGEMENT POLICIES AND INSTRUMENT.
Organization for Economic Co-Operation and Development, Paris (France).
For primary bibliographic entry see Field 5G.
W79-04856

REPORT OF THE DENVER WORKSHOP ON STATE-LOCAL-FEDERAL RELATIONSHIPS IN SOCIOECONOMIC IMPACT ASSESSMENT,
Denver Research Inst., CO. Industrial Economics Div.
R. Schneider, and J. S. Gilmore.
Sponsored by the Resource and Land Investigations Program, U.S. Geological Survey, Denver, Colorado. December 15-16, 1976. 44 p, 1 fig, 7 appendices.

Descriptors: *Assessments, *Planning, *Impacts, *Energy impacts, *Impact studies, *Socioeconomic impacts, Evaluation, Energy, Resources development, Legislation, Colorado, Montana, New Mexico, Wyoming, North Dakota, Utah, Navajo Nation, Energy development.

This is a summary of discussion among Federal, state, academic, and local participants in a two day workshop of the socioeconomic impacts caused by energy resource development in the Rocky Mountain and Northern Plains states. Three general criteria were proposed by the Energy Research and Development Administration (ERDA): the initiative and responsibility of the states for problem-solving must be preserved, enhanced and facilitated; Federal impact assistance should be broadly legislated and not be tied to specific and potentially obsolete energy technologies; and that states should enter the decision-making process concerning impacts from a regional perspective, actively soliciting regional and local input. Examined are the impact decision approaches of Colorado, Montana, New Mexico, Wyoming, the Navajo Nation, North Dakota and Utah. Both Montana and Wyoming have comprehensive environmental energy legislation providing for local and citizen input into decisions arising from impacts of energy policies and energy facilities siting. An Epilog sets out legislative changes made by the states in their impact assessment activities since in Conference was held. The Resources and Land Investigation (RALI) program is described in Appendix D. (Arnold-NC)
W79-04858

STONY BROOK HARBOR: AN INTERDISCIPLINARY ANALYSIS,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
S. K. Robbins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 442, Price codes: A06 in paper copy, A01 in microfiche. June 1977. 115 p, 24 fig, 6 tab, 93 ref, 3 append.

Descriptors: *Coasts, *Water quality, *Harbors, *Land use, *New York, *Stony Brook Harbor(NY), Water pollution control, Water resources development, Shore protection, Jurisdiction, Management, Recreation, Wetlands, Biota, Coastal Zone Management.

The purpose is to organize and evaluate data and knowledge concerning a marine resource so that it is presented in a form useful to managers and planners. The first step in the development of an information base for a resource such as Stony Brook Harbor is the definition of the resource, i.e., the collection and compilation of data and knowledge relevant to both the physical and human environments of the study area. This included obtaining information on geologic structure, wetlands, uplands, biota, water quality, shoreline development and stability, hydrography and sediments. Other steps included delineating the patterns of use (past, present and alternative) and their compatibility; distributing governmental authority; and managing and planning policies. Stony Brook Harbor is located on the North Shore of Long Island on the boundary of Smithtown and Brookhaven Townships, in Western Suffolk County. It is used as a recreational water body for activities such as boating, clamming, swimming, and fishing. There is very little industry in the area and water pollution from this source is negligible. A short history of the harbor area is given describing the settlement patterns in the 18th, 19th, and 20th centuries. Indirect and direct conflicts between users of the harbor are presented showing the major source of direct conflict is over space requirements. The major source of indirect conflict is the alteration of the marine environment by two users, boaters and shoreline residents. This paper can serve as an example of a study that could be done for other Long Island Harbors and bays, as a first step in the development of management plans for their use. (Arnold-NC)
W79-04862

A FEASIBILITY STUDY FOR DEVELOPING A RESERVOIR ON BIG COW CREEK, NEWTON COUNTY, TEXAS.
Sabine River Authority of Texas, Orange; and Henningson, Durham and Richardson, Inc., Henderson, TX.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 703, Price codes: A10 in paper copy, A01 in microfiche. Department of Commerce Economic Development Administration Technical Assistance Project October, 1976. 197 p. 08-6-01623.

Descriptors: *Water quality, *Water supply development, *Water resources development, *Water resources, *Water demand, *Reservoirs, *Environmental effects, *Feasibility studies, *Newton County(TX), *Big Cow Creek(TX), *Multi-purpose projects, Reservoir storage, Water storage, Engineering structures, Economics, Economic feasibility, Natural resources, Flora, Fauna, Wildlife, Hydrology, Biology, Climatic data, Environmental control, Sabine River(TX), Historic resources.

On October 15, 1975 the Sabine River Authority of Texas authorized the preparation of a feasibility study for developing a reservoir on Big Cow Creek in Newton County, TX. The report is divided into 4 sections: study evaluation and summary, engineering and economics, environmental considerations, and evaluation of historic and prehistoric resources. The storage capacity of the reservoir will be 34,200 acre feet (AF) covering about 2,600 acres and costing an estimated $12,026,332. The reservoir would be capable of passing a 100-year flood. The watershed is primarily undeveloped pine and hardwood forest with forest covering over 90% of the area. The project will be multipurpose providing municipal water supply, increased recreation facilities, flood control, irrigation water, and water for industrial users. Data are presented on water quality in the area, the financial aspects of the project, the engineering requirements of the reservoir, hydrological characteristics of the area, and the geological and biological impacts of the reservoir on the local economy and environment. It is estimated that the reservoir would be adequate to provide water needs to the year 2025, but alternative surface water supplies might be necessary to meet industrial water needs in the next 25-50 years. Short and long-term adverse effects are discussed with alternatives to the proposed action considered. A preliminary evaluation of the recorded historic and prehistoric resources in the area is presented indicating that no federal or state registered historic sites are threatened by the proposed reservoir. (Coan-NC)
W79-04867

A SOCIO-ECONOMIC FEASIBILITY STUDY OF THE PROPOSED ROCHESTER DAM,
W. L. Hoffman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 888, Price codes: A05 in paper copy, A01 in microfiche. Department of Commerce, Technical Assistance Project, Economic Development Administration. November, 1977. 78 p, 6 fig, 19 tab, 22 ref.

Descriptors: *Dams, *Cost benefit analysis, *Agriculture, *Reservoirs, *Rochester Dam(KY), *Economic impact, *Social impact, Recreation, Reservoir construction, Construction costs, Economics, Land use, Navigation, Industry, Income, Project benefits.

This study examines the desirability of construction of a multipurpose dam on the green River in Butler, Kentucky. The purpose of the proposed Rochester Dam is to create a wide range of economic and social benefits for the area. The proposed project would flood 52,000 land acres, requiring the purchase of 71,000 acres in all. An estimated 240 families would have to be relocated, with some 50,500 acres of crop and pasture lands being inundated. The proposed maximum pool elevation of 420 feet would have no effect on the subteranean streams in Mammoth Caves, but the author believes further study should be undertaken to insure the integrity and well-being of this natural resource. The area is rural, with low median income, and suffers from out-migration and under- and unemployment, with limited industrial and commercial potential. Costs and benefits of the project are presented. The findings indicate that although agricultural crop losses would occur--estimated at over $300 million over a 50 year period--and a loss of a sense of community by part of the population would result from resettlement, the overall benefits justify construction of the dam. These benefits include revitalization of the area's economy through construction employment; purchases of goods and commodities by the federal government and local construction workers, which would spur employment and purchase of services; recreation benefits, providing both recreation resources and increased employment; increases in land values and the construction of vacation homes; opening of the area to river navigation; providing industrial opportunities and benefits; and hydroelectric energy production. Flood control and water supply are not considered significant. Construction of the Rochester Dam is recommended. (Arnold-NC)
W79-04869

IMPROVEMENTS NEEDED IN THE CORPS OF ENGINEERS' REGULATORY PROGRAM FOR PROTECTING THE NATION'S WATERS.
General Accounting Office, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 312, Price codes: A02 in paper copy, A01 in microfiche. December 23, 1977. 16 p, 1 tab.

Descriptors: *Water quality, *Wetlands, *Water resources planning, *Impacts, *Water pollution control, *Corps of Engineers, Permits, Federal Water Pollution Control Act, Water management(Applied), Regulatory programs, Impact assessments.

This report assesses the aspects of the need for improvement in the Army Corps of Engineers' implementation of Sections 10 and 404 of the 1972 Federal Water Pollution Control Act Amendments. The GAO, concluded that headquarters and districts will have management and evaluation difficulties until the Corps (1) defines the geographical boundaries of its Section 10/404 regulatory program, (2) provides for more consistency between districts in interpreting and applying regulations and guidelines, (3) defines methods to be used to achieve program results, and (4) provides for periodic review of program results. It was found that Corps failure to specifically identify geographical boundaries within each district led to confusion over which area actually would be covered by Corps permits. The need for the Corps to better coordinate its permits with similar ones required by EPA was identified. Additional guidance to Corps districts needs to be provided to reconcile conflicting interests which may be involved. Peri-

odic evaluation should be made specifically to provide more data on the wetlands regulatory program. (Arnold-NC)
W79-04871

RECREATIONAL BOATING ON THE TIDAL WATERS OF MARYLAND. A MANAGEMENT STUDY.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 068, Price codes: A10 in paper copy, A01 in microfiche. Prepared for the Maryland Department of Natural Resources, Energy and Coastal Zone Administration and NOAA, Office of Coastal Zone Management, Washington, DC. 1976. 226 p, 14 fig, 22 tab, 5 appendices.

Descriptors: *Water quality, *Tidal waters, *Water users, *Shore protection, *Environmental effects, *Outdoor recreation, *Recreation demand, *Recreation facilities, *Boating, *Coastal zone management, *Chesapeake Bay, *Navigational safety, Estuaries, Fish management, Ecosystems, Environmental control, Zoning, Management, Maryland, Carrying capacity, Spatial capacity, Licensing, Congestion, Resources management.

The tidal waters of Maryland are priceless recreational resources, unique estuarine ecosystems, essential navigation routes, and valuable assets for waterfront land. The recent increase in recreational boating activity and facility construction prompted an assessment of the problems arising from such activities and the development of a planning framework to identify and rectify these problems. This report studies the environmental effects of boating and develops a planning process and management strategy which will allow administrators, private boaters, and concerned citizens to consider problems and alternative solutions. Congested areas on the tidal waters and existing problems are identified through qualitative surveys of boater perceptions and State Police observations, consultations with officials, and analysis of accident loci. A review of relevant environmental literature was undertaken to determine the degree to which ecological effects and impacts could be attributed to recreational boating activities and facility development. Information relevant to both user-related concerns and environmental sensitivities and geographical management units are delineated and classified. It was found that localized overcrowding is a serious concern; accident occurance rates have not increased in spite of increases in number of boats registered; demand for boating facilities greatly exceeds supply; boating facilities impinge on sensitive shoreline resources; it will be necessary to increase State Dept. of Natural Resources capabilities for dealing with boating activities and facilities development. Management alternatives to ameliorate boater and environmentally related alternatives are presented. (Coan-NC)
W79-04876

COMPUTER PROGRAMMING SOLID SET SYSTEMS,
Toro Co., Riverside, CA.
For primary bibliographic entry see Field 3F.
W79-04913

A METHODOLOGY FOR DETERMINING LAND VALUE AND ASSOCIATED BENEFITS CREATED FROM DREDGED MATERIAL CONTAINMENT,
SCS Engineers, Reston, VA.
For primary bibliographic entry see Field 5E.
W79-04933

PRELIMINARY ASSESSMENT OF POLICY AND MANAGEMENT OPTIONS FOR GROUNDWATER MINING IN THE GREAT PLAINS,
Kansas Water Resources Research Inst., Manhattan.
For primary bibliographic entry see Field 4B.
W79-04957

SUMMARY REPORT OF PHASE II. DEVELOPMENT OF TECHNIQUES FOR ESTIMATING THE POTENTIALS OF WATER RESOURCES DEVELOPMENT IN ACHIEVING NATIONAL AND REGIONAL SOCIAL GOALS.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 030, Price codes: A02 in paper copy, A01 in microfiche. Report PRWG-112-1. May 1973 Edited and published at the California University, Riverside, 15 p. OWRT C-3337(No. 3721)(10).

Descriptors: *Planning, *Social values, *Decision making, *Water policy, Evaluation, Social aspects, Model studies, Conservation, Recreation, Aesthetics, Water resources development.

A concept for comprehensive evaluation of effects of water resource use and development was proposed in Phase I. (See W72-00796). Nine general word described goals thought collectively to be comprehensive were articulated into successive hierarchical sets of subgoals seen as eventually linked to social indicators that are perturbed by water actions. By devising connectives among the elements of the goal tree, social indicators and action variables, relative social effects for alternatives can be studied. Phase II developed a number of working papers on various aspects of the methodology in anticipation of a field test. Results of these working papers are summarized. Topics include algorithmic approaches to semi- or non-quantifiable connectives, documentation of specific quantifiable connectives, hydrological interactions with social indicators, recreational quality and supply, ecological resiliency, action variables, alternative action plants, equality, cognitive aspects of social indicators, quantification of aesthetics and results of some preliminary tests based on the Dorfman-Jacoby theoretical Bow River case and Perris Dam in California. (Peterson-Utah)
W79-04965

ECONOMIC ANALYSES OF MULTIPLE PIVOT IRRIGATON ON A DROUGHTY SOIL,
Minnesota Univ., Minneapolis. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W79-04995

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

A MODEL FOR DETERMINING THE IMPACT OF CONTROL COSTS ON MUNICIPAL FINANCES,
Army Concepts Analysis Agency. Bethesda, MD.
A. C. Rucks.
Journal of the Water Pollution Control Federation, Vol. 51, No. 1, p 43-52, 1979 January. 2 fig, 11 tab, 5 ref.

Descriptors: *Water pollution control, *Costs, *Effects, *Municipal finances, *Micro analysis, Methodology, Waste water(Pollution), Measurement, Mathematical models, Systems analysis, Data analysis.

The objective of the micro analysis model is to measure the impact of alternative water pollution control facility financing methods on the operating position of a municipality's water and sewer fund. The four alternative methods included in the model taxonomy are representative of the local, state, and federal sources of capital that are generally available to municipalities. Model methodology consists of the preparation of pro forma financial statements based on trend analysis of the water and sewer fund financial conditions. These pro forma financial statements present clear pictures of the deficit or surplus conditions that can be expected under each of the facility financing methods. (Bell-Graff--Cornell)
W79-04698

ECONOMICS OF ON-FARM METHODS OF CONTROLLING SEDIMENT LOSS FROM SURFACE-IRRIGATED FIELDS,
For primary bibliographic entry see Field 4D.
W79-04756

'SCOPE FOR VALUATION OF ENVIRONMENTAL GOODS': COMMENT,
University of New England, Armidale (Australia). Dept. of Agricultural Economics.
P. W. O'Hanlon, and J. A. Sinden.
Land Economics, Vol. 54, No. 3, p 381-387, August 1978. 2 tab, 3 ref.

Descriptors: *Value, *Methodology, *Pricing, *Economics, *Parks, *Social values, *Recreation demand, Australia, National Parks, New South Wales(Australia), Marginal utility, Prices, Equilibrium, Surveys, Attitudes, Goods, Services.

Modifications reduce the subjectivity of Pendse and Wyckoff's method (1974) of estimating values for unpriced environmental goods and services and improve its precision through resurveys, a test between sets of prices, and an explicit attempt to bracket the range of each price. The revised method was applied to a proposed National Park at the headwaters of the Macleay River, New South Wales, Australia. The original methodology simulates operation of a competitive market; at equilibrium the marginal utility per unit of expenditure on any one good equals the marginal utility per unit on any other good. This condition is translated into a simple test (implemented through questionnaires) for indicating adjustments to experimental prices in order to move to equilibrium prices. Comparison of random or expected frequencies of choice (E) with observed frequencies (O) shows how well given prices reflect marginal utilities or values. An O/E ratio greater than 1.0 implies that prices underestimate respondents' values since the quantity chosen is too high, and prices must be increased to estimate equilibrium prices; for a ratio less than 1.0 the reverse holds true. It is noted that the method indicates the direction but not the magnitude of the needed adjustment. The proposed resurveys and tests between sets of prices offers a more systematic means of selecting a price matrix. (Lynch-Wisconsin)
W79-04757

DRAINAGE INSTALLATION EQUIPMENTS 'ECONOMICS OF THE ART',
Speicher Corp., Celina, OH.
For primary bibliographic entry see Field 5G.
W79-04910

6D. Water Demand

APPLICATION OF ON-LINE PREDICTION TECHNIQUES TO FORECASTING SHORT TERM AGRICULTURAL WATER DEMAND,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
A. Szollosi-Nagy.
In: IIASA Conference '76, Volume 2. The International Institute for Applied Systems Analysis, Laxenburg, Austria, p. 19-23, 1976. 2 fig, 8 equ, 5 ref.

Descriptors: *Water demand, *Short-term planning, *Forecasting, *Irrigation systems, *Tisza River Basin(Hungary), Probability, Algorithms, Equations, Systems analysis, Dynamic model, Dynamic recursive prediction, Harmonic series model, Computers.

An urgent problem in the Tisza River basin is the short-term control of its irrigation systems which are of great economic significance. Discussed herein is a proposed discrete, dynamic recursive prediction algorithm that is based on the state space description of the processes involved. The algorithm can readily be embedded into an on-line control scheme. Because of the recursiveness, the scheme is easy to implement even for small process computers. It is simply adapted to suit the changing environment, and the algorithms might be embedded without change in the optimal control scheme for the irrigation system. (See also W79-04686) (Bell-Graf--Cornell)
W79-04689

SUPPLY-DEMAND PRICE COORDINATION IN WATER RESOURCES MANAGEMENT,
Milan Univ. (Italy). Ist. di Elettrotechnica ed Elettronica.
G. Guariso, D. Maidment, S. Rinaldi, and R. Soncini-Sessa.
RR-78-11, International Institute for Applied Systems Analysis, Laxenburg, Austria, July 1978. 24 p, 10 fig, 3 tab, 3 equ, 10 ref.

Descriptors: *Water supply, *Water demand, *Coordination, *Prices, *Water management(Applied), *Methodology, Water utilization, Water delivery, Networks, Optimization, Inter-basin transfers, Mexico, Mathematical models, Equations, Systems analysis, Linear programming, Benefit maximization, Interaction graph, Disaggregated approach, Aggregated approach.

Presented is a price coordination scheme for solution of a complex regional water management problem; the problem specifically is to coordinate by prices the water supplies and demands in a region. The objective is to maximize the total regional net benefit from water use, and it is achieved when the marginal benefit at each demand point is equal to the marginal cost of delivering water to that point. The class of problems to which the scheme can be applied is determined from the graph of the network connecting supplies and demands. An example is presented in which the scheme is applied to analyze possible interbasin water transfers in the Northwest Water Plan in Mexico. The method works in the 'marginal domain,' thus making use of demand and supply models describing the economy of the single units of the system. The scheme is essentially a one-dimensional search coordinated by a supervisor. Its advantages with respect to aggregated cost-benefit analysis are the saving of computation time and memory requirements, the fact that the information structure needed is highly decentralized, and the fact that the marginal benefits or costs associated with each unit are explicitly obtained as part of the problem solution. (Bell-Graf--Cornell)
W79-04718

'SCOPE FOR VALUATION OF ENVIRONMENTAL GOODS': COMMENT,
University of New England, Armidale (Australia). Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6C.
W79-04757

ECONOMIC ISSUES RELATED TO LARGE-SCALE WATER TRANSFERS IN THE USA,
Colorado Univ., Boulder. Dept. of Economics.
C. W. Howe.
Water Supply and Management, Vol. 2, No. 2, p 127-136, 1978. 2 tab, 3 ref.

Descriptors: *Economics, *Water transfer, *Water shortage, *Regional economics, *Cost-benefit analysis, *Planning, *Demand, Regional planning, Regional development, Economies of scale, Financing, Economic efficiency, Arid lands, Energy, Water management(Applied), Economic feasibility, Benefits, Costs, Water supply, Theoretical analysis, Interbasin transfers.

Benefits, costs, timing, and financing of existing and proposed water transfer systems are assessed. Existing systems include New York City, Los Angeles, and the Colorado-Big Thompson projects, and proposed systems include the Columbia River Basin, Texas-New Mexico high plains, and the lower Mississippi projects. Economic benefit issues: (1) low benefits in agriculture, (2) agricultural displacement effects, (3) efficiency of use of transferred waters, (4) benefits along the transfer route, and (5) secondary benefits. Economic cost issues: (1) energy intensity and energy recovery, and (2) water opportunity costs and other externalities. Project timing is critical; premature construction means unused capacity for long periods, while deferring construction leads to interim use of costly short-term supplies or delayed regional growth. The low unit value of water and economies of scale in all water transfer technology imply that interregional transfers must be large to be economically feasible. Inefficient large-scale water projects are much less likely to be undertaken if public financial policy requires direct and secondary beneficiaries to pay a major portion of construction, operating, and maintenance costs. In early transfer projects financing was done completely by the water utility by means of bonds paid off through volume charges to users, while federal financing has resulted in many inefficient projects. Full cost recovery is recommended. (Lynch-Wisconsin)
W79-04759

HYDROLOGIC APPRAISAL OF THE WATER RESOURCES OF THE HOMER-PREBLE VALLEY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
W. Buller.
Geological Survey Water-Resources Investigations 78-94 (open-file report), 1978. 31 p, 8 fig, 7 tab, 15 ref.

Descriptors: *Water suply, *Surface waters, *Groundwater, *Available water, *Water quality, Hydrologic data, Hydrogeology, Water analysis, Potable water, Planning, Construction, New York, *Homer-Preble Valley.

Water resources of Homer-Preble Valley, 1 to 2 miles wide and 9 miles long, in central New York, were appraised because the area is expected to undergo considerable residential development in the near future. The main source of water supply to the residents of the area is the glacial-outwash aquifer. Data indicate that additional pumpage of 5 million to 10 million gallons per day from the aquifer would not seriously reduce the quantity and quality of the water supply. Water-quality analyses indicate that ground water and surface water in the valley are suitable for most uses and generally meet State standards for source waters for drinking. (Woodard-USGS)
W79-04796

WATER POLICY AND DECISION-MAKING IN THE COLORADO RIVER BASIN,
California Univ., Santa Barbara. Dept. of Political Science.
For primary bibliographic entry see Field 6E.
W79-04868

PLANNING STATUS REPORT: WATER RESOURCE APPRAISALS FOR HYDROELECTRIC LICENSING--LOWER WHITE RIVER BASIN, MISSOURI-ARKANSAS.
Federal Energy Regulatory Commission, Washington, DC. Bureau of Power.
For primary bibliographic entry see Field 4A.
W79-04872

PLANNING STATUS REPORT: WATER RESOURCE APPRAISALS FOR HYDROELECTRIC LICENSING--UPPER WHITE RIVER BASIN, MISSOURI AND ARKANSAS.
For primary bibliographic entry see Field 4A.
W79-04873

WATER BANKING: HOW TO STOP WASTING AGRICULTURAL WATER,
California Univ., Berkeley. Graduate School of Public Policy.
For primary bibliographic entry see Field 3F.
W79-04875

6E. Water Law and Institutions

INSTITUTIONAL ARRANGEMENTS FOR EFFECTIVE WATER MANAGEMENT IN COLORADO,
Colorado State Univ., Fort Collins.
L. L. Marcum.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 569, Price codes: A07 in paper copy, A01 in microfiche. MA Thesis, 1978. 134 p, 8 ref, 3 append. OWRT A-029-COLO(1).

Descriptors: *Institutions, *Administration, *Water law, *Colorado, Legal aspects, Constitutional law, Interstate compacts, Legislation, Decision making, Political aspects, Economic impact, Social impact, Surveys.

Institutional changes having the potential for improving water management in Colorado are discussed. Fourteen hypotheses concerning the political, economic and social factors contributing to the present state of the Colorado water system are presented and analyzed. The historical development of Colorado water institutions is summarized, and Colorado constitutional provisions, statutes, lead court cases, and interstate compacts dealing with water and water management are reviewed. The impact of Federal water agencies on the Colorado system is analyzed. It was concluded from the interviews concerning the hypotheses that local decision making is preferred to centralized state determinations, and that individual decision making is preferred to governmental decision making. (Davison-IPA)
W79-04503

FEDERAL WATER POLLUTION CONTROL ACT: THE SECTIONS 316 (A) AND 316 (B) PROCESS,
National Marine Fisheries Service, Ann Arbor, MI. National Power Plant Team.
E. S. Fritz.
Report No. FWS/OBS-76/20.5, August 1978. 15 p, 5 fig, 7 ref.

Descriptors: *Federal Water Pollution Control Act, *Thermal pollution, *Adjudication procedures, Effluent streams, Electric powerplants, Steam, Cooling towers, Environmental effects, Technology, Permits, Legal aspects, Pollutants, Water pollution sources, Water pollution abatement, Water quality, Water quality control.

The sections of the Federal Water Pollution Control Act Amendments of 1972 which pertain to thermal discharges and steam electric powerplants are described. Section 316 (a) provides for the modification of effluent limitations and standards of performance for thermal discharges. Section 316 (b) requires that the location, design, construction, and capacity of cooling water intake structures represent the best technology available for minimizing adverse environmental impacts. The provisions of the act are implemented through the NPDES permit system. The act requires that intake and discharge impacts be distinguished although the two are inseparable. Schematic flow charts illustrate the process and adjudacatory procedures; planning and submission of 316 (a) demonstration; planning and submission of 316 (b) studies for existing intake structures; studies for new source intake structures; and studies for new intake (not new source) structures. The adjudication process and the Fish and Wildlife Service role in implementing the act are outlined. (Davison-IPA)
W79-04507

METHODOLOGY FOR DESIGNING COST-EFFECTIVE MONITORING AND COMPLIANCE STRATEGIES FOR PESTICIDE USE,
CONSAD Research Corp., Pittsburgh, PA.
For primary bibliographic entry see Field 6A.
W79-04524

POLLUTION CONTROL GUIDANCE FOR GEOTHERMAL ENERGY DEVELOPMENT,
Industrial Environmental Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 5C.
W79-04530

PROBLEMS OF PUBLIC ACCESS TO WATER IN TEXAS LAKES AND STREAMS: AN ANALYSIS,
Texas Tech Univ., Lobbock. Dept. of Geography.
O. W. Templer.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 503, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Center, Texas Tech University Project Completion Report January 1979. 125 p, 22 fig, 142 ref. OWRT A-042-TEX(1). 14-34-0001-7092. 14-34-0001-8046.

Descriptors: *Water law, Water rights, *Public access, Stream beds, *Texas.

This report examines the problems surrounding public access to the state-owned waters of Texas' lakes and streams, one of the most poorly understood areas of water and property law. Limited access to public water resources is becoming an increasingly serious problem as the state's rapidly growing populace seeks to avail itself of water-based recreational opportunities. The development of water and land law relating to public access is reviewed. Texas' complex water law history, combining diverse Hispanic-Anglo elements, along with the general absence of public land, make comparisons with other jurisdictions difficult. Unlike Gulf coastal waters and beaches, there is no express statutory recognition of the right of public access to inland waters. However, a number of cases do recognize the right for a variety of purposes; but because most of the law turns on the unique fact situations of each case, it is impossible to develop generally applicable legal principles. The problems of determining navigability and stream bed ownership in the context of Texas' statutory definition are reviewed, as are the even more tenuous rights of public use of banks and shores of navigable waterways. Once public access is attained, numerous impediments such as fences, dams, etc., often confront the would-be recreationist. Such obstacles are illustrated and discussed, as are the spatial aspects of access sites. Finally, unsuccessful alternatives which might have solved some of the recurrent problems are examined. Short of currently unacceptable comprehensive legislation, there are few measures to help resolve the growing controversy between the recreation-seeking public and private landowners in Texas.
W79-04555

PUBLIC PERCEPTIONS OF ISSUES AND PROBLEMS IN THE LAKE CHAMPLAIN BASIN AREA, A SUMMARY,
Cornell Univ., Ithaca, NY.
For primary bibliographic entry see Field 2H.
W79-04558

WATER LAW - RIGHTS OF IMPORTERS AND DEVELOPERS OF WATER. CITY AND COUNTY OF DENVER V. FULTON IRRIGATING DITCH CO., 506 P.2D 144 (COLO. 1972),
Wyoming Univ., Laramie. Water Resources Research Inst.; and Wyoming Univ., Laramie. Coll. of Law.
D. B. Riggs.
Land and Water Law Review, Vol. 9, No. 2, p 543-552, 1974. OWRT A-003-WYO(7), 14-31-0001-4051.

Descriptors: *Water law, *Water rights, *Colorado, *Diversion, Colorado River, Legal aspects, *Imported water, *Denver(Colo).

The City and County of Denver obtains water from the Colorado River Basin by means of a transmountain diversion. After being used by Denver the water is treated and released into the South Platte River above the headgates of the defendant ditch company. In an action brought by Denver which sought approval for the sale of the imported water, the Colorado Supreme Court held that the city could re-use or make successive use of water which it had imported and that it could dispose of such water after use. Consequently, appropriators from the South Platte acquired no rights in the imported water unless such rights were acquired under a contractual arrangement with the importer. The law regarding rights inhering in imported water and the problems encounterd in identifying such water are discussed. In addition, the economic and environmental implications of the legal doctrines regarding the re-use of water are explored.
W79-04594

LEGAL PROBLEMS IN CHANGING USES OR COORDINATING USES OF KEYHOLE RESERVOIR,
Wyoming Univ., Laramie. Water Resources Research Inst; and Wyoming Univ., Laramie. Coll. of Law.
K. D. Wagner.
Land and Water Law Review, Vol. 9, No. 2, p 485-506, 1974. OWRT A-003-WYO(6), 14-31-0001-4051.

Descriptors: Wyoming, *Reservoirs, Irrigation water, Supplemental irrigation, *Recreation, Legislation, Legal aspects, Keyhole Reservoir(Wyo).

Keyhole Dam and Reservoir, in northeastern Wyoming was constructed by the Bureau of Reclamation for purposes of providing supplemental water for irrigation as well as flood protection. Although irrigators have not taken advantage of the available water supply from Keyhole, extensive use has been made of the facility for recreational purposes. These recreational uses and potential industry use of water conflict with the authorized utilization of Keyhole. The various means by which the authorized uses of the reservoir may be changed or coordinated are explored. The authorizing legislation for the project and the administrative powers of the Bureau of Reclamation are discussed. Possible solutions for resolving the user conflict are outlined and the procedural ramifications are explored. Emphasis is placed on the possibilities for mutual water administration to accommodate the various uses, alternative supplies, purchase of water by the state, and changing the authorizing legislation.
W79-04595

AN ANALYSIS OF PLAYA LAKE WATER UTILIZATION ON THE TEXAS HIGH PLAINS,
Texas Tech Univ., Lubbock. Dept. of Geography.
O. W. Templer.
Water Resources Bulletin, Vol. 14, No. 2, p 454-465, April 1978. 3 fig, 34 ref. OWRT-A-029-TEX(2), 14-31-0001-5044 & 6045.

Descriptors: *Playas, *Lakes, *Water law, *Water utilization, Hydrographs, Ogallala formation, Water rights, High Plains(Texas).

Examined are the spatial, temporal and legal aspects of playa lake water utilization on the semi-arid Texas High Plains. These small basins of interior drainage collect and briefly hold an estimated two to three million acre-feet of runoff water annually, representing from one-fourth to one-third the quantity of groundwater pumped from the dwindling Ogallala aquifer. Once considered a detriment to farming operations, there is now increased interest in using playa water more effectively. At present, direct pumping is the chief method of utilization, and modification of lake bottoms to concentrate runoff and reduce evaporation is the most widespread conservation practice. The use of playa water for groundwater recharge is hampered by as yet unsolved technical problems. For many years the question of ownership of playa water remained unsettled. The Texas Water Rights Commission now classes it as diffused surface water, which under Texas law may be used by the landowner, though some legal problems remain. For playa lakes to be effectively integrated into the regional water resource, it becomes imperative that all present and prospective water utilization problems be identified and resolved. (Bell-Cornell)
W79-04611

SPECULATIVE POLICY MAKING IN THE ENVIRONMENTAL ARENA,
West Virginia Univ., Morgantown. Dept. of Political Science.
D. C. Menzel, and D. G. Williams.
Water Resources Bulletin, Vol. 14, No. 2, p 374-383, April 1978. 4 tab, 5 ref. OWRT A-032-WVA(1), 14-34-0001-7104.

Descriptors: *Water policy, West Virginia, Environment, Water law, Assessment, Legislation, Agencies, Reorganizaton, Political aspects, Institutions, Decision making.

The development of policy in the American political system has been characterized by incremental change, creation of support, bargaining, compromise, pluralistic group interplay, development of social and political support, technical input, review, and consideration. Incrementalism allows policy to develop in tandem with technical knowledge, legislative and executive support, political advantage, and presumably greater certainty concerning the impact of a particular choice. Environmetal policy development, one scholar has hypothesized, followed this basic pattern until the late 1960's when policy aspirations began to escalate much faster than the knowledge, organizational arrangements and political support upon which policy implementation depends. This 'escalation' hypothesis is examined herein, with particular attention given to policy development in West Virginia. (Bell-Cornell)
W79-04613

INTERNATIONAL PROBLEMS,
M. B. Holburt.
In: Values and Choices in the Development of the Colorado River Basin, The University of Arizona Press, Tucson, Arizona, 1978, p 220-237. 2 fig, 1 tab, 11 ref.

Descriptors: *Colorado River, Colorado River Basin, Water pollution control, Mexican Water Treaty, Legislation, Salinity.

This paper discusses the Colorado River water quality and quantity problems between the United States and Mexico, considerations that have led to the several agreements between the two countries and possible future actions. (Skogerboe-Colorado State)
W79-04660

ENVIRONMENTAL CONSIDERATIONS IN THREE INFRASTRUCTURE PLANNING AGENCIES: AN OVERVIEW OF RESEARCH FINDINGS,
Stanford Univ., CA. Dept. of Civil Engineering.
L. Ortolano, C. M. Brendecke, J. E. Price, and J. J. Meersman.
Report No. IPM-6, December 1978. 100 p, 1 tab, 34 ref, 4 append. NSF PRA-75-22340.

Descriptors: *Planning, *Project planning, Bureau of Reclamation, Army Crops of Engineers, Department of Transportation(California), Environmental effects, Institutions, Data transmission.

Research is reported which tests a priori hypotheses concerning relationships between the influence of environmental information on planning results, and aspects of planning grouped as follows: organizational design; coordination with other agencies and the public; timing of environmental studies and coordination; and the attitudes of planners. The hypotheses were tested using data from interviews with 118 planners and environmental specialists who were instrumental in water resources and highway planning investigations carried out by the U.S. Bureau of Reclamation, the U.S. Army Corps of Engineers, and the California Department of Transportation. The most strongly supported hypotheses were those indicating that environmental information strongly influences planning outcomes in studies where: (1) early and extensive coordintion exists between agencies and the public; and (2) environmental specialists function as active planners communicating frequently with engineering planners, and whose duties include a broad range of activities besides environmental impact assessment. (Davison-IPA)
W79-04680

LAKE STURGEON POPULATIONS, GROWTH, AND EXPLOITATION IN LAKES POYGAN, WINNECONNE, AND LAKE BUTTE DES MORTS, WISCONSIN,

Wisconsin Dept. of Natural Resources, Madison.
For primary bibliographic entry see Field 6G.
W79-04755

WATER-ORIENTED OUTDOOR RECREATION IN THE ILLINOIS RIVER BASIN (APPENDIX VD--ILLINOIS-INDIANA-WISCONSIN.
Bureau of Outdoor Recreation, Philadelphia, PA. Northeast Regional Office.
For primary bibliographic entry see Field 6B.
W79-04853

WATER MANAGEMENT POLICIES AND INSTRUMENT.
Organization for Economic Co-Operation and Development, Paris (France).
For primary bibliographic entry see Field 5G.
W79-04856

THE RIVER'S REACH: A UNIFIED PROGRAM FOR FLOOD PLAIN MANAGEMENT IN THE CONNECTICUT RIVER BASIN.
New England River Basins Commission, Boston, MA.
For primary bibliographic entry see Field 4A.
W79-04857

REPORT OF THE DENVER WORKSHOP ON STATE-LOCAL-FEDERAL RELATIONSHIPS IN SOCIOECONOMIC IMPACT ASSESSMENT,
Denver Research Inst., CO. Industrial Economics Div.
For primary bibliographic entry see Field 6B.
W79-04858

A FEASIBILITY STUDY FOR DEVELOPING A RESERVOIR ON BIG COW CREEK, NEWTON COUNTY, TEXAS.
Sabine River Authority of Texas, Orange; and Henningson, Durham and Richardson, Inc., Henderson, TX.
For primary bibliographic entry see Field 6B.
W79-04867

WATER POLICY AND DECISION-MAKING IN THE COLORADO RIVER BASIN,
California Univ., Santa Barbara. Dept. of Political Science.
D. E. Mann.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 025, Price codes: A04 in paper copy, A01 in microfiche. National Science Foundation, Research Applied to National Needs, Lake Powell Research Project Bulletin No. 24, July 1976. 56 p, 55 ref. G134840.

Descriptors: *Water quality, *Water supply, *River basin development, *Water resources, *Water policy, *Lake Powell(CO), *Colorado River Basin, Energy, Environmental effects, Water treatment, Economic development, Decision-making, Planning, Mexico, Redistribution, Politics, Environmental management, Energy resources.

Water quality in the Colorado River Basin is a crucial issue because of increasing salinity, the Mexican demands for better quality water, and new legislation pertaining to water quality standards. This report discusses the water policy and decision-making process in the Basin, the energy issue as it relates to water policy, and future policy and decision-making issues. It examines the extent to which traditional patterns of decision-making may be changing in light of new policy considerations. The Mexican demand for improvements in the quality of the water it receives conflicts with the energy policy because the development of energy resources will increase the pollution problem. The report describes the Salinity Control Program, the setting in which it was developed, and how the energy issue complicates the goals of the program. Energy development in the region is accepted by both the public and its leaders, but there is concern regarding the environmental consequences. The impacts of energy development on the region are analyzed. The traditional decision-making process for water policies is described as distributive and this framework is discussed. Future developments may alter the framework to one of 'regulatory' or 'redistributive' and the consequences of this shift are discussed. (Coan-NC)
W79-04868

IMPROVEMENTS NEEDED IN THE CORPS OF ENGINEERS' REGULATORY PROGRAM FOR PROTECTING THE NATION'S WATERS.
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 6B.
W79-04871

WATER BANKING: HOW TO STOP WASTING AGRICULTURAL WATER,
California Univ., Berkeley. Graduate School of Public Policy.
For primary bibliographic entry see Field 3F.
W79-04875

WATER QUALITY PLANNING IN NORTH CAROLINA,
North Carolina Univ. at Chapel Hill. Dept. of Regional Planning.
D. H. Moreau.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 970, Price codes: A03 in paper copy, A01 in microfiche. July 1977. 30 p, 7 fig, 2 tab.

Descriptors: *Water quality planning, *Water resources development, *Waste treatment, *Water quality standards, *Water policy, *Water quality control, *North Carolina, *Stream classification, River basins, Resource management, Water pollution, Land use planning, Effluents, Regulation, Government, Planning, Water law, Federal Water Pollution Control Act of 1972.

An historical glimpse of North Carolina's water quality planning efforts and an assessment of contemporary efforts at water supply and water quality planning are discussed. The first efforts to protect public drinking water supplies were in 1903 when the N.C. State Board of Health was charged with the responsibility of developing a regulatory program to protect public water supplies. These efforts were intensified in the post-World War I era when growing industrial and population demands strained water resource capabilities. The first comprehensive assessment of waste water discharges published in 1947 by the State Stream Sanitation and Conservation Committee are described. This committee had no regulatory authority over discharges into streams. In 1951, the first comprehensive pollution control legislation was passed, consisting of 4 major elements: (1) development of water quality standards based on stream use; (2) surveys of existing pollution and water quality in major river basins; (3) classifications of streams according to best use; and (4) formulation of comprehensive pollution abatement plans based on stream classification and water quality standards. Present attempts at water quality planning arise from the State's response to the FWPCA 1972 (PL92-500). This three-tiered approach to water quality planning is described in depth: river basin planning, areawide planning, and facilities planning. The present organizational structure of State water resource planning and major constraints to effective planning are also offered. (Coan-NC)
W79-04922

ANALYSIS OF ALASKA'S WATER USE ACT AND ITS INTERACTION WITH FEDERAL RESERVED WATER RIGHTS,
Alaska Univ., Fairbanks. Arctic Environmental Information and Data Center.
H. J. Curran, and L. P. Dwight.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 061, Price codes: A03 in paper copy, A01 in microfiche. Institute of Water Resources, University of Alaska Publication No. 98. February 1979. 33 p, 34 ref. OWRT A-059-ALAS(1), 14-34-0001-7003.

Descriptors: *Water law, *Prior appropriation, *Water permits, *Water policy, *Water rights, Legal aspects, Riparian rights, Wildlife management, Alaska, Minimum stream flows.

Since the passage of Alaska's Water Use Act in 1966, the amount of water required by Alaska's growing population and resource development has increased very rapidly. The need to review the adequacy of existing water use laws and their administration has been expressed both by those trying to comply with regulations and by those attempting to enforce standards and permit requirements. The historical development of the doctrine of prior appropriation in Alaska is summarized. The statutory authority, regulations, and administration of Alaska's Water Use Act by the Alaska Department of Natural Resources are presented. Overlapping state agency authorities are discussed, and existing and proposed regulations are analyzed. The application of federal reserved water rights to Alaska and the status of quantification of these rights is explained. Options are presented for the State of Alaska to manage water use on federal lands, and for preserving minimum stream flows for maintenance of fish and wildlife habitats.
W79-04959

INSTITUTIONAL CHANGE AND FIRE MANAGEMENT,
California Univ., Berkeley. Dept. of Forestry and Conservation.
R. G. Lee.
In: Proceedings of the Symposium on the Environmental Consequences of Fire and Fuel Management in Mediterranean Ecosystems, August 1977, USDA Forest Service General Technical Report WO-3, p 202-214, 4 fig. (CA. Water Resources Center Project UCAL-WRC-W-499). OWRT-A-058-CAL(2).

Descriptors: *Fire, *Forest management, *Burning, Social aspects, Social change, Institutions, Organizations.

This paper examines how social organization facilitates control over wildfire. A theory of institutional change is used to interpret the history of social organizational efforts to regulate fire in California's wildlands. Three types of institutions are described: (1) local volunteers that provided the primary means for fuel and fire management in the first eight years of that state, (2) fire control bureaucracies that have provided fire protection for the last fifty years, and (3) possible new organizational means for integrating fire and fuel management with other land management activities. It is concluded that, in addition to more scientific and technical knowledge, institutional changes will require new commitments by individuals and the realignment of organizations with new interests. (Snyder-Calif.-Davis)
W79-04966

ENVIRONMENTAL AND INSTITUTIONAL ASPECTS OF IRRIGATION AGRICULTURE,
Science and Education Administration, Riverside, CA. Salinity Lab.
For primary bibliographic entry see Field 3F.
W79-04978

6F. Nonstructural Alternatives

METHODOLOGY FOR EVALUATION OF FEASIBILITY: MULTIJURISDICTIONAL URBAN DRAINAGE AND FLOOD CONTROL PROJECTS.
Urban Drainage and Flood Control District, Denver, CO.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 576, Price codes: A04 in paper copy, A01 in microfiche. Report February 1977. 63 p, 13 fig, 8 tab, 7 ref, 2 append. OWRT B-113-COLO(11).

Descriptors: *Flood control, *Urban drainage, *Feasibility, Project planning, Flood plains, Management, Evaluation, Colorado, Cost-benefit analysis, Damages, Tangible benefits, Intangible benefits, Drainage districts, Drainage programs.

A methodology enabling engineers to evaluate the feasibility of urban drainage and flood control (UDFC) projects is reported. Currently, interest is increasing in nonstructural solutions to flooding. In addition to providing better land use plans and flood plain management, nonstructural programs allow more efficient use of public funds. Historically UDFC projects have emphasized reducing and preventing property damage. Twelve proposed objectives for flood control in the Denver area to be considered in a feasibility study are presented. The methodology is divided into three parts: (1) a technique for comparing the costs and benefits of UDFC projects on the basis of damage reduction; (2) techniques for displaying descriptive information concerning all other project benefits; and (3) a tradeoff analysis. A multijurisdictional case study based on the Little Dry Creek Master Plan project is examined and discusse. (Davison-IPA)
W79-04502

PUBLIC PERCEPTIONS OF ISSUES AND PROBLEMS IN THE LAKE CHAMPLAIN BASIN AREA, A SUMMARY,
Cornell Univ., Ithaca, NY.
For primary bibliographic entry see Field 2H.
W79-04558

PLANNING STORM-DRAINAGE SYSTEMS FOR URBAN GROWTH,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
S. A. Dendrou, J. W. Delleur, and J. J. Talavage.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. WR1, p 1-16, November 1978. 10 fig, 1 equ, 19 ref. OWRT-B-083-IND(8).

Descriptors: *Urban hydrology, *Simulation analysis, *Urban runoff, Zoning, Planning, Drainage, Floods, Model studies, Systems analysis, On-site storage, Nonstructural alternatives, Storm water runoff, Urbanization.

A package is developed that integrates and interfaces an urban growth simulation model and an urban hydrology model, so as to explicitly evaluate the effectiveness of nonstructural measures, e.g., zoning as far as the drainage system is concerned. Alternate growth scenarios can thus be directly related to the corresponding storm-drainage systems of specified standards of performance. Among the remaining 'Best Management Practice' control options, the on-site storage, treatment and controlled overflow are retained as accurately representing the facets of urban storm-water management relevant at the planning stage. This is achieved by including these controls in a simulation of the hydrologic behavior of each local drainage basin of an urban agglomeration separately. An application is made for a medium size community in Indiana. (Bell-Cornell)
W79-04618

6G. Ecologic Impact Of Water Development

INFLUENCE OF TURBIDITY ON FISH ABUNDANCE IN WESTERN LAKE SUPERIOR,
Wisconsin Univ.-Superior. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W79-04532

TUBERCULATION OF PEARL DACE, SEMOTILUS MARGARITA (PISCES: CYPRINIDAE),
Maryland Univ., College Park. Center of Environmental and Estuarine Studies.
J. A. Fava, and C-f. Tsai.
Copeia, No. 2, p. 370-374, May 17, 1976. 1 fig, 2 tab, 7 ref. OWRT B-006-MD (8).

Descriptors: *Fish, *Fish pysiology, *Fish reproduction, Growth stages, Fish behavior, Spawning, Biorhymthms, Ecology, Pearl dace, Hamilton Run(Maryland).

The breeding tuberoles of S. margarita and their seasonal development are described. A breeding male and a breeding female were selected for tubercular measurement, and the mean length and diameter of the tubercles on each part of the body and fins were calculated by measuring about five tubercles with an ocular micrometer under the dissection microscope. Tubercles are present almost completely over the head and body of the breeding male, and are more widely distributed over the body of this species than in other species of Semotilus. On the breeding female, tubercles are much less developed than on males. The developed than on males. The development of breeding tubercles of this species parallels gonadal maturation. Development in males begins in November, and the tubercles reach their greatest size and number from March through May. After spawning there is a rapid loss of tubercles, and in June no males had them. In females the development of tubercles begins later than in males, and disappear more quickly. The biological significance of the breeding tubercles as related to breeding behavior is described. (Davison-IPA)
W79-04663

WATER IN LAND USE PLANNING.
New Mexico Wate Resources Research Inst., Las Cruces.
For primary bibliographic entry see Field 6A.
W79-04681

LAKE STURGEON POPULATIONS, GROWTH, AND EXPLOITATION IN LAKES POYGAN, WINNECONNE, AND LAKE BUTTE DES MORTS, WISCONSIN,
Wisconsin Dept. of Natural Resources, Madison.
G. R. Priegel, and T. L. Wirth.
Technical Bulletin, No 107, 1978. 23 p, 12 fig, 14 tab, 11 ref.

Descriptors: *Wisconsin, *Lake sturgeon, *Lake Poygan(WI), *Lake Winneconne(WI), *Lake Butte des Morts(WI), *Fish management, *Sport fishing, *Spear fishing, *Regulation, Commercial fishing, Lake Winnebago, Acipenser fulvescens, Lakes, Creel census, Fish populations, Fish conservation, Fisheries, Productivity, Wildlife management.

Lake sturgeon (Acipenser fulvescens) in Lakes Poygan, Winneconne, and Butte des Morts, part of Wisconsin's Lake Winnebago chain, declined 1952-76. Overharvest is indicated by: (1) decrease in number of fish speared per fisherman, (2) increase in the harvest of sturgeon under 50 in., (3) decrease in the harvest of larger size classes, (4) a downward trend in the age of harvested fish, (5) changes in mortality rates, and (6) increase in number of ice fishing shanties counted on the lakes. Throughout their range in the U.S. and Canada lake sturgeon populations are markedly reduced and support commercial or sport fisheries in only a few areas; the largest sport fishery is in Lake Winnebago (which is not overfished) and in the three upriver study lakes. Since 1952 only spear fishing has been allowed, and the minimum length has been increased from 30 in. in 1952 to 45 in. in 1974; bag limit was reduced to one fish in 1957, with the minimum fishing age set at 16. The annual 16-day season in 1952 was gradually reduced to the current two days every five years (1976 was the most recent season). Probably inaccurate creel census estimates of total harvest were 200 in 1952, 784 in 1953, and 879 in 1954. Estimates since 1955 based on registrations showed a high of 715 in 1955 and a low of 80 in 1968; the harvest was 227 in 1971 and 85 in 1976. Lake Poygan now accounts for 99% of fish speared on the upriver lakes. Management alternatives include maintenance of the present season, limiting fishing pressure, and regulation through minimum size limits. (Lynch-Wisconsin)
W79-04755

A FEASIBILITY STUDY FOR DEVELOPING A RESERVOIR ON BIG COW CREEK, NEWTON COUNTY, TEXAS.
Sabine River Authority of Texas, Orange; and Henningson, Durham and Richardson, Inc., Henderson, TX.
For primary bibliographic entry see Field 6B.
W79-04867

RECREATIONAL BOATING ON THE TIDAL WATERS OF MARYLAND. A MANAGEMENT STUDY.
For primary bibliographic entry see Field 6B.
W79-04876

AN EVALUATION OF THE EFFECTS OF GEOTHERMAL ENERGY DEVELOPMENT ON AQUATIC BIOTA IN THE GEYSERS AREA OF CALIFORNIA,
California Univ., Berkeley. Div. of Entomology and Parasitology.
V. H. Resh, T. S. Flynn, G. A. Lamberti, and E. McElravy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 031, Price codes: A04 in paper copy, A01 in microfiche. California Water Resources Center, University of California, Davis. Technical Completion Report, February 1979. 59 p, 5 fig, 7 tab. (California Water Resources Center Project UCAL-WRC-W-519), OWRT-A-063-CAL(1).

Descriptors: Caddisflies, *Geepers, *Thermal water, *Hot springs, *Stream, *Aquatic life, Aquatic insects, Biological communities, California.

The Geysers of Sonoma County, California, currently the largest geothermal energy field in the world, is expected to expand its electrical generating capacity considerably in the coming years. However, these future developments may result in watershed modification and potentially deleterious effects on aquatic biota due to the topography of this area. Analysis of the response of benthic populations and communities to past and ongoing geothermal energy development and operational practices was undertaken by means of an extensive six site sampling program on Big Sulfur Creek and a concentrated colonization study above, in, and on Big Sulfur Creek and a concentrated colonization study above, in, and below a heavily impacted tributary (Little Geysers Creek). Differences in species diversity were noted among the six Big Sulfur Creek sites that were selected relative to the presence or absence of natural fumaroles or hot springs and the absence or stage of geothermal energy development. Distribution and colonization patterns of a population of sericostomatid caddisfly, Gumaga nigricula, and especially its dominance in high silt areas, suggest that both siltation and fumarole activity may select for certain populations. (Snyder-Calif. Davis)
W79-04962

7. RESOURCES DATA

7B. Data Acquisition

ENHANCEMENT OF WATER-QUALITY MONITORING SYSTEMS BY INCORPORATING WATER-QUALITY MODELLING AND TIME-SERIES ANALYSIS,
Water Pollution Research Lab., Stevenage (England).
For primary bibliographic entry see Field 5B.
W79-04571

THE WATER WITCH: FACT . . . OR FICTION.
P. Call.
Pacific Groundwater Digest, Vol. 2, No. 1, p 30-35, January 1979.

Descriptors: *Dowsing, *Groundwater, *Drilling, Water wells, Exploration.

Despite the fact that dowsing is being given serious consideration in scientific circles and that modern dowsers are successful, respected businessmen, they are still considered fakes by many people in the drilling industry and by hydrogeologists. The U.S.G.S. concluded that further tests to establish the validity of dowsing were not justified. Jay Lehr, the executive director of the National Water Well Association, states that dowsers are partly to blame for the fact that out ground water resources are underdeveloped. Wayne Thompson, one of the trustees of the American Society of Dowsers, feels that dowsing is an equally good alternative to geology in locating water and that there is not much conflict between geologic theory and dowsing theory. The vein concept od dowsers, in geologic terms, would be an area which is more permeable than the surrounding region and through which groundwater tends to flow. Not everyone can dowser and even successful dowsers occassionally miss. Modern dowsers are questioning their abilities and looking for science and technology for answers. Dowsing has gone hand in hand with the water well industry for centuries and it is as widely practived as it ever was. Whether fact or fiction, dowsing is her to stay. (Purdin-NWWA)
W79-04578

SEWER NETWORK SCHEME FOR DIGITAL COMPUTATIONS,
Texas Univ. at Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W79-04590

THE APPLICATION OF OPTIMAL LINEAR REGULATOR THEORY TO A PROBLEM IN WATER POLLUTION,
Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
C. B. Winn, and J. B. Moore.
IEEE Transactions of Systems, Man, and Cybernetics, Vol. SMC-3, No. 5, p 450-455, September, 1973. 7 fig, 9 ref. OWRT-C-2207(3410)(11), 14-31-0001-3410.

Descriptors: *Model studies, Water pollution, Sewerage, *Combined sewers, *Treatment facilities, Standards, Overflow, Storage capacity, *Control systems, *Waste water treatment, Regulators.

A model has been developed with the objective of utilizing the total storage capacity available in the system in such a manner as to minimize water pollution resulting from overflows at individual points within the system. In addition, it is required that no abrupt changes in control be admitted, as this is likely to lead to undesirable surges. The nonlinear model is shwon to fit within the framework of an optimal regulator problem with derivative constraints. The optimal feedback control law is derived and compared with the optimal bang-bang controller. The solution technique that is presented may be applied to many combined storm-sewer systems in which the flows through the systems to the treatment plants may be controlled. It may be used by municipal engineers to determine necessary modifications to existing systems so as to meet new water pollution standards. (Sandoski-FIRL)
W79-04596

BIOLOGICAL SURVEILLANCE OF RIVERS: A BIOLOGICAL MONITORING HANDBOOK,
Water Pollution Research Lab., Stevenage. (England).
J. M. Hellawell.
Water Research Centre, Stevenage, Herts. 1978. 332 p.

Descriptors: *Rivers, *Biology, *Monitoring, Water quality, Water pollution, Surveys, Water quality standards, Sampling, Invertebrates, Fish, Aquatic animals, Benthic fauna, Aquatic microorganisms, Biota, Bibliographies, On-site investigations, Data processing, Aquatic microbiology, Biological communities.

This 10-chapter monograph deals with water quality and pollution surveys, including monitoring objectives, water standards and criteria, field surveys, sampling strategies (for macroinvertebrates, fish, benthic organisms, macrophytes, etc.), data analysis and biotic indices, comparisons of data-handling methods, presentation and interpretation of survey results, and sources of additional help (keys for taxa identification, mathematical tables, bibliographic references, etc.). (Brown-IPC)
W79-04634

PESTICIDE TRANSPORT AND METABOLISM IN MODEL SYSTEMS,
Agricultural Research Service, Beltsville, MD. Pesticide Degradation Lab.
For primary bibliographic entry see Field 5B.
W79-04661

SOLAR ENERGY INFORMATION AND DATA FOR ILLINOIS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2B.
W79-04719

ON THE DETECTION OF SHALLOW AQUIFERS USING THERMAL INFRARED IMAGERY,
Connecticut Univ., Storrs. Dept. of Geology and Geophysics.
D. Huntley.
Water Resources Research, Vol. 14, No. 6, p 1075-1083, December 1978. 11 fig, 21 ref. NASA NGL 06-001-015.

Descriptors: *Remote sensing, *Aquifers, *Infrared radiation, Temperature, Heat flow, Thermal radiation, Theoretical analysis, Laboratory tests, On-site investigations, Simulation analysis, Mathematical models, Model studies, Groundwater, Soil water, Soils, Soil moisture, On-site data collections, Thermal inertia, Shallow aquifers.

Patterns appearing on a thermal infrared image are primarily a function of the temperature of the earth's surface. Diurnal surface temperatures are affected by the thermal inertia and solar reflectance of the surface, by meteorologic variables, by evaporation rates, and by subsurface temperature effects such as the effect due to varying groundwater depth. Variations in surface material result in variations in both thermal inertia and solar reflectance, causing a change in both the magnitude of temperatures through the diurnal cycle and the amplitude of diurnal temperature variation. Variations in soil moisture result in similar effects and, in addition, result in a change in evaporative cooling rates. Variation in groundwater depth produces an effect on surface temperature that is discriminable from variations in solar reflectance and thermal inertia but is not discriminable from variations in evaporative cooling rates. (Sims-ISWS)
W79-04745

SATELLITE SNOW-COVER OBSERVATIONS IN ARIZONA,
Geological Survey, Phoenix, AZ. Water Resources Div.
H. H. Schumann.
In: Proceedings of the American Society of Photogrammetry Fall Technical Meeting, Albuquerque, New Mexico, October 15-20, 1978, p 480-489, 1978. American Society of Photogrammetry, Falls Church, Virginia. 7 ref.

Descriptors: *Remote sensing, *Snow cover, *Snow surveys, *Photogrammetry, *Arizona, Mapping, *Salt-Verde watershed.

A variety of satellite imagery is available for operational snow-cover mapping in central Arizona. The high-resolution multispectral imagery acquired by satellites of the experimental Landsat series particularly is well suited for snow-cover mapping at the commonly used scale of 1:1,000,000. The use of Landsat imagery for operational monitoring of the rapid changes in snow-covered areas in central Arizona is limited by the cloud cover and by the once each 9-day coverage now available. (Woodard-USGS)
W79-04803

TIME-DEPENDENCE OF SEA-ICE CONCENTRATION AND MULTIYEAR ICE FRACTION IN THE ARCTIC BASIN,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center; and Geological Survey, Tacoma, WA. Water Resources Div.
P. Gloersen, H. J. Zwally, A. T. C. Chang, D. K. Hall, and W. J. Campbell.
Boundary-Layer Meteorology 13, p 339-359, 1978. 13 fig, 1 tab, 21 ref.

Descriptors: *Remote sensing, *Sea ice, *Ice-water interfaces, *Arctic, *Satellites(Artificial), Infrared radiation, Microwave images.

The time variation of the sea-ice concentration and multiyear ice fraction within the pack ice in the Arctic Basin is examined, using microwave images of sea ice recently acquired by the Nimbus-5 spacecraft and the NASA CV-990 airborne laboratory. The images used for these studies were constructed from data acquired from the Electrically Scanned Microwave Radiometer (ESMR) which records radiation from earth and its atmosphere at a wavelength of 1.55 cm. Data are analyzed for four seasons during 1973-1975 to illustrate some basic differences in the properties of the sea ice during those times. Spacecraft data are compared with corresponding NASA CV-990 airborne laboratory data obtained over wide areas in the Arctic Basin during the Main Arctic Ice Dynamics Joint Experiment (1975) to illustrate the applicability of passive-microwave remote sensing for monitoring the time dependence of sea-ice concentration (divergence). These observations indicate significant variations in the sea-ice concentration in the spring, late fall and early winter. In addition, deep in the interior of the Arctic polar sea-ice pack, heretofore unobserved large areas, several hundred kilometers in extent, of sea-ice concentrations as low as 50% are indicated. (Woodard-USGS)
W79-04811

MORPHOMETRY OF A TIDAL MOUTH, ACCORDING TO ITS DISCRETE MODEL,
For primary bibliographic entry see Field 2L.
W79-04950

RAPID DETERMINATION OF SOIL WATER CHARACTERISTIC BY THERMOCOUPLE PSYCHROMETRY,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2G.
W79-04987

7C. Evaluation, Processing and Publication

OCCURRENCE, QUANTITY, AND QUALITY OF GROUND WATER IN TAYLOR COUNTY, TEXAS.
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 2F.
W79-04575

ANALYTICAL STUDY OF THE OGALLALA AQUIFER IN DAWSON AND BORDEN COUNTIES, TEXAS, PROJECTIONS OF SATURATED THICKNESS, VOLUME OF WATER IN STORAGE, PUMPAGE RATES, PUMPING LIFTS, AND WELL YIELDS,
Texas Dept. of Water Resources, Austin.
A. E. Bell, and S. Morrison.
Report 225, November 1978. 70 p, 18 tab, 74 ref, 24 map.

Descriptors: *Groundwater resources, *Texas, *Aquifers, *Data collections, Groundwater, Maps, Water resources, Aquifer characteristics, Groundwater recharge, Water supply, Groundwater availability, Groundwater mining, Overdraft, Pumping, Projections, Saturated flow, Water wells,

*Dawson County(TX), *Borden County(TX), *Ogallala aquifer(TX), Pumpage rates, Pumping lifts, Well yields.

This is one of numerous planned county studies covering the declining groundwater resource of the Ogallala aquifer in the High Plains of Texas. The report contained maps, charts, and tabulations which reflect estimates to the volume of water in storage in the Ogallala aquifer in Dawson and Borden Counties and the projected depletion of this water supply by decade periods through the year 2020. Included were estimates of pumpage, pumping lifts, and other data related to current and future water use in the counties. However, the report did not attempt to project that portion of the volume of water in underground storage which may be ultimately recoverage. The Ogallala aquifer in Dawson and Borden Counties contained approximately 3.8 million acre-feet of water in 1974. Historical pumpage has exceeded 90,000 acre-feet annually, which is more than twice the rate of natural recharge to the aquifer in the counties. This overdraft is expected to continue, ultimately resulting in reduced well yields, reduced acreage irrigated, and reduced agricultural production. (Humphreys-ISWS)
W79-04576

SIMULATION OF URBAN NON-POINT SOURCE POLLUTION,
CH2M/Hill, Redding, CA.
For primary bibliographic entry see Field 5B.
W79-04609

PUBLIC GROUNDWATER SUPPLIES IN WARREN COUNTY,
Illinois State Water Survey, Urbana.
D. M. Woller, K. L. Kunz, and E. W. Sanderson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 713, Price codes: A02 in paper copy, A01 in microfiche. Bulletin 60-25, 1978. 20 p, 2 fig.

Descriptors: *Water supply, *Illinois, *Groundwater resources, *Well data, Unconsolidated aquifers, Gravels, Sand aquifers, Bedrock, Sandstones, Dolomite, Groundwater availability, Groundwater, Water souces, Water quality, Water wells, Data collections, Municipal water, Water yield, Water properties, Hardness(Water), Chemical properties, Deep wells, Shallow wells, Geology, Aquifers, Drillers logs, *Warren County(IL), Dissolved minerals, Water bearing formations.

All available information on production wells used for public groundwater supplies in Warren County, Illinois, was presented. The definition of public water supply as contained in the Environmental Protection Act of 1970 was used to determine those water systems and wells to be included. The report included separate descriptions for 6 groundwater supplies furnishing water to 5 municipalities and 1 subdivision in Warren County. These descriptions were preceded by brief summaries of the groundwater geology of the county and the development of groundwater sources for public use. Individual production wells for each supply were described in the order of the construction. The description for each well included the aquifer or aquifers tapped, date drilled, depth, driller, legal location, elevation in feet above mean sea level, log, construction features, yield, pumping equipment, and chemical analyses. (Humphreys-ISWS)
W79-04720

A MATHEMATICAL DETERMINISTIC RIVER-QUALITY MODEL. PART 2: USE IN EVALUATING THE WATER-QUALITY MANAGEMENT OF THE BLACKWATER CATCHMENT,
Thames Water Authority, Reading (England).
For primary bibliographic entry see Field 5B.
W79-04722

OPTICS OF TURBID ESTUARINE WATERS: APPROXIMATIONS AND APPLICATIONS,
Hydroscience, Inc., Westwood, NJ.
For primary bibliographic entry see Field 1A.
W79-04734

WATER RESOURCES DATA FOR COLORADO, WATER YEAR 1977--VOLUME 1. MISSOURI RIVER BASIN, ARKANSAS RIVER BASIN, RIO GRANDE BASIN.
Geological Survey, Lakewood, CO. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 258, Price codes: A17 in paper copy, A01 in microfiche. Geological Survey Water-Data Report CO-77-1, November 1978. 369 p, 4 fig, 4 tab, 40 ref.

Descriptors: *Colorado, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, Missouri River basin, *Arkansas River basin, *Rio Grande basin.

Water-resources data for Colorado for the 1977 water year consists of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs, and water levels and water quality of wells and springs. This report (volumes 1, 2, and 3) contains discharge records for 424 gaging stations, 5 partial-record flow stations, 79 crest-stage partial-record stations, and 193 miscellaneous sites; stage and contents of 25 lakes and reservoirs; water quality for 134 gaging stations and 60 miscellaneous sites; and water levels for 55 observation wells. A few pertinent stations in bordering States are included in this report. The records were collected and computed by the Water Resources Division of the U.S. Geological Survey. These data represent that portion of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Colorado. (Woodard-USGS)
W79-04790

WATER RESOURCES DATA FOR COLORADO, WATER YEAR 1977--VOLUME 2. COLORADO RIVER BASIN ABOVE DOLORES RIVER.
Geological Survey, Lakewood, CO. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 259, Price codes: A17 in paper copy, A01 in microfiche. Geological Survey Water-Data Report CO-77-2, December 1978. 368 p, 4 fig, 4 tab, 41 ref.

Descriptors: *Colorado, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Colorado River basin, *Dolores River.

Water-resources data for Colorado for the 1977 water year consists of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs, and water levels and water quality of wells and springs. This report (volumes 1, 2, and 3) contains discharge records for 424 gaging stations, 5 partial-record flow stations, 79 crest-stage partial-record stations, and 193 miscellaneous sites; stage and contents of 25 lakes and reservoirs; water quality for 134 gaging stations and 60 miscellaneous sites; and water levels for 55 observation wells. A few pertinent stations in bordering States are also included in this report. The records were collected and computed by the Water Resources Division of the U.S. Geological Survey. These data represent that portion of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Colorado. (Woodard-USGS)
W79-04791

WATER RESOURCES DATA FOR COLORADO, WATER YEAR 1977--VOLUME 3. DOLORES RIVER BASIN, GREEN RIVER BASIN, SAN JUAN RIVER BASIN.
Geological Survey, Lakewood, CO. Water Resources Div.
Geological Survey Water-Data Report CO-77-3, December 1978. 412 p, 4 fig, 4 tab.

Descriptors: *Colorado, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Dolores River basin, *Green River basin, *San Juan River basin.

Water resources data for Colorado for the 1977 water year consists of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs, and water levels and water quality of wells and springs. This report (volumes 1, 2, and 3) contains discharge records for 424 gaging stations, 5 partial-record flow stations, 79 crest-stage partial-record stations, and 193 miscellaneous sites; stage and contents of 25 lakes and reservoirs; water quality for 134 gaging stations and 60 miscellaneous sites; and water levels for 55 observation wells. A few pertinent stations in bordering States are also included in this report. The records were collected and computed by the Water Resources Division of the U.S. Geological Survey. These data represent that portion of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Colorado. (Woodard-USGS)
W79-04792

SUMMARY OF HYDROLOGIC DATA COLLECTED DURING 1976 IN DADE COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. E. Hull.
Geological Survey open-file report 78-883, October 1978. 83 p, 57 fig, 8 tab, 16 ref.

Descriptors: *Hydrologic data, *Water quality, *Surface waters, *Groundwater, Canals, Saine water intrusion, Discharge(Water, Water yield, Water level fluctuations, Hydrographs, Aquifers, Water utilization, Florida, *Dade County.

During 1976 rainfall was 1.58 inches below the long-term average. Ground-water levels ranged from 0.4 foot above to 0.5 foot below average. The highest and lowest ground water for the year were both 1 foot below their long-term averages. In the Hialeah-Miami Springs area, water levels in wells near the centers of the heaviest pumping ranged from 8.0 to 9.5 feet below msl (mean sea level, 1929); and in the southwest well-field area, groundwater levels near the centers of pumping ranged from 2.0 feet above to 3.0 feet below msl. The combined average daily discharge from nine major streams and canals that flow eastward into tidal waters was 1,666 cubic feet per second (cfs), 609 cfs above the combined average daily flow for the 1975 water year. The combined average daily flow through the Tamiami Canal outlets was 783 cfs, 215 cfs above that of the 1975 water year. The 1976 position of the salt fron in the coastal part of the Biscayne aquifer was about the same as in 1975 except in the vicinity of Mowry Canal south of Homestead Air Force Base where the salt front had encroached farther inland. (Woodard-USGS)
W79-04795

PENNSYLVANIA ANNUAL PROGRESS REPORT, 1978,
Geological Survey, Harrisburg, PA. Water Resources Div.
D. R. Miller.
Geological Survey Pennsylvania District Report, 1978. 91 p.

Descriptors: *Water resources, *Projects, *Annual, *Reviews, *Pennsylvania, Surface waters, Groundwater, Water quality, Streamflow, Gaging stations, Reservoirs, Water wells, Water

supply, Land use, Water utilization, Mapping, Sampling, Sites, Urbanization, Water pollution, Publications, Bibliographies, *Annual summary report.

This report describes the projects, the accomplishments, and the activities of the Water Resources Division of the Geological Survey resources programs over the 1978 fiscal year in the Commonwealth of Pennsylvania. The diversification of the projects reflects the growth and the national interests of the United States. They show the problems and challenges that present-day managers, developers, and users of water face in these times of natural resources conflicts. The Commonwealth and Nation are making every effort to solve the problems of energy, environment, economy and urbanization. (Woodard-USGS)
W79-04797

WATER RESOURCES AND GEOLOGY OF THE SPRINGFIELD AREA, MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div; and Missouri Dept. of Natural Resources, Rolla. Div. of Geology and Land Survey.
L. F. Emmett, J. Skelton, R. R. Luckey, D. E. Miller, and T. L. Thompson.
Missouri Department of Natural Resources, Water Resources Report No. 34, 1978. 150 p, 35 fig, 4 plates, 22 tab, 4 ref, 2 append.

Descriptors: *Surface-groundwater relationships, *Groundwater availability, *Groundwater potential, *Water sources, *Computer models, Base flow, Karst hydrology, Groundwater movement, Aquifers, Maps, Water supply, Wells, Potentiometric level, Low flow, Flood flow, Groundwater recharge, Water use, Reservoir storage, Runoff, Water quality, Geology, Urban runoff, Missouri, *Springfield area, Seepage run, Streamflow losses.

Two aquifers separated by dolomitic siltstone and shale, are present in the Springfield area, Missouri. The principal ground-water supply is the major aquifer, which consists of over 1,000 ft of dolomite of Cambrian-Ordovician age. The minor aquifer, which is as much as 300 ft thick, consists of cherty limestones of Mississippian age. Seepage runs were made during low and high base-flow conditions to locate stream reaches where losses occur. Losses to bedrock were defined in Pearson, Pickerel, and Terrell Creek basins. The quality of ground and surface water is generally good, but a potential for ground-water contamination does exist in the cavernous limestone terrane. Approximately 8.0 Mgal/d is withdrawn from the major aquifer. A digital model of the aquifer indicates that additional water can be withdrawn if users can tolerate additional lowering of a potentiometric surface. Present (1976) municipal water usage of 15 Mgal/d could be sustained during severe drought conditions with no additional sources required, but additional sources would be necessary by the early 1980's. (Woodard-USGS)
W79-04798

MAPS SHOWING FORMATION TEMPERATURES AND CONFIGURATIONS OF THE TOPS OF THE MINNELUSA FORMATION AND THE MADISON LIMESTONE, POWDER RIVER BASIN, WYOMING, MONTANA, AND ADJACENT AREAS,
Geological Survey, Cheyenne, WY. Water Resources Div.
W. J. Head, K. T. Kilty, and R. K. Knottek.
Geological Survey open-file report 78-905, November 1978. 12 p, 5 fig, 6 ref.

Descriptors: *Groundwater resources, *Hydrogeology, *Water temperature, *Maps, *Structural geology, Mapping, Profiles, Contours, Borehole geophysics, Geothermal studies, Regional development, Coal mines, Evaluation, Planning, Wyoming, Montana, *Powder River Basin.

This report is part of a study to describe the hydrogeologic framework needed to evaluate the water resources of the Paleozoic age aquifers in the Northern Great Plains coal region. Preliminary studies by the U.S. Geological Survey and State agencies in Wyoming, Montana, and South Dakota have indicated that these aquifers might provide a significant percentage of the water requirements for coal development. Geologic and water-temperature data for the Minnelusa Formation of Permian and Pennsylvanian age and for the Madison Limestone (Group where it is subdivided) of Mississippian and locally late Devonian age, and their equivalents, were compiled and interpreted. Maps were produced showing the altitude and groundwater temperatures of the top of these formations. The altitude (configuration) maps show the depth and position of the formations throughout the area. Temperature maps can be used to calculate changes in the viscosity of water caused by large temperature differences. The viscosity differences will be useful in adjusting calculated transmissivity aquifer values (the rate at which water can be transmitted through an aquifer). (Woodard-USGS)
W79-04799

WATER-QUALITY INVESTIGATION OF THE YELLVILLE WATERSHED, ARKANSAS,
Geological Survey, Little Rock, AR. Water Resources Div.
T. E. Lamb, and C. S. Williams.
Geological Survey open-file report 78-904, 1978. 17 p, 1 fig, 4 tab, 10 ref.

Descriptors: *Water quality, *Baseline studies, *Surface waters, *Groundwater resources, *Arkansas, Geology, Water analysis, Topography, Planning, *Presoil conservation program, *Yellville watershed, Town Branch.

The results of a 1-year study of surface-water quality in the Yellville watershed are presented to document conditions before implementation of Soil Conservation Service programs. Analyses of samples collected at three sites showed that water in Town Branch and East Prong Branch was of good quality except for bacteria, total residue, and sulfate concentrations, which at times exceeded criteria established by the Arkansas Department of Pollution Control and Ecology. (Woodard-USGS)
W79-04802

WATER-LEVEL DECLINES IN THE MADISON AREA, DANE COUNTY, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
R. S. McLeod.
Geological Survey open-file report 78-936, November 1978. 15 p, 9 fig, 2 tab, 5 ref.

Descriptors: *Groundwater, *Pumping, *Drawdown, *Water levels, *Computer models, Aquifer characteristics, Streamflow, Average flow, Hydrologic data, Water demand, Water supply, Maps, Projections, Wisconsin, *Madison area, *Surface water declines.

The water supply for the city of Madison, Wisconsin, and for surrounding municipalities is obtained from the ground-water reservoir that underlies the area. This ground-water reservoir is composed of an upper aquifer and an underlying sandstone aquifer. High-capacity water-supply wells pump from the sandstone aquifer. Pumping from the sandstone aquifer has resulted in hydrologic changes. The water level has dropped in both the upper aquifer and underlying sandstone aquifer, and the flow of water in streams has been reduced. The effects of anticipated pumping were examined with the use of a digital model. The maximum water-level decline from the beginning of pumping in 1882 until 1975 was about 75 feet in the sandstone aquifer and 10 to 20 feet in the upper aquifer. Additional declines between 1975 and 2000 were computed to be 10 to 30 feet in the sandstone aquifer and 5 to 10 feet in the upper aquifer. The average annual streamflow of the Yahara River at the McFarland gaging station was reduced 32 percent from the beginning of pumping to 1975. An additional 7 percent reduction in streamflow was computed for the period 1975 to 2000. (Woodard-USGS)
W79-04809

8. ENGINEERING WORKS

8A. Structures

CONSTRUCTION COSTS FOR MUNICIPAL WASTEWATER CONVEYANCE SYSTEMS: 1973-1977.
Dames and Moore, Denver, CO.
For primary bibliographic entry see Field 6B.
W79-04761

TRENCHLESS DRAINAGE,
Advanced Drainage Systems, Inc., Columbus, OH.
R. C. Reeve.
Paper No. 78-2042, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 9 p. 9 fig. ASAE, St. Joseph, Michigan.

Descriptors: *Subsurface drainage, Subsurface drains, Drainage practices, Trenches, Costs, Groundwater.

Following the development of corrugated plastic tubing and automatic laser grade control in the 1960s, a dramatic move the 'trenchless' drainage has taken place in the 1970s. Low maintenance costs and high installation rates (up to 50,000 ft. per day) has given the competitive edge that is shifting the industry from trench to 'trenchless' drainage. (Skogerboe-Colorado State)
W79-04912

8B. Hydraulics

SLUICE GATES WITH HIGH DISCHARGE COEFFICIENTS,
Concordia Univ., Montreal (Quebec). Dept. of Civil Engineering.
For primary bibliographic entry see Field 8C.
W79-04572

UNIFORMLY DISCHARGING LATERAL WEIRS,
Concordia Univ., Montreal (Quebec). Dept. of Civil Engineering.
A. S. Ramamurthy, K. Subramanya, and L. Carballada.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 104, No. IR4, Proceedings Paper 14252, p 399-412, December 1978. 8 fig, 2 tab, 11 ref, 3 append.

Descriptors: *Irrigation systems, *Discharge(Water), *Weirs, Laboratory tests, Flumes, Irrigation, Open channels, Open channel flow, Uniform flow, Model studies, Mathematical models, Hydraulics, Hydrodynamics, *Lateral weirs.

In certain applications, such as automated irrigation systems, multiple lateral weirs are housed in open channels in which spatially decreasing flow occurs. When the channel bed slope and the friction slope are very small, spatially decreasing subcritical channel flow results in a rising profile in the reach containing the multiple lateral weirs. This causes nonuniform distributions of weir outflows. For purposes of analysis, a single equivalent weir was considered, and it was shown that uniform water surface profile ensuring uniform outflow can be obtained by modifying the weir system geometry. The proposed methods are simple and easy to construct, even in existing channels. A number of tests were conducted to verify the proposed methods. The present study was limited to rectangular open channels. (Sims-ISWS)
W79-04573

HARD-ROCK WELLS GET MARIPOSA THROUGH THE DROUGHT,
California Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 3B.
W79-04579

A PROCEDURE FOR INTERPOLATING THE DEPTH DISTRIBUTION OF SOIL MOISTURE TENSION (IN GERMAN),
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
H. Fluehler, and F. Richard.
Z Pflanzenernaehr Bodenkd, Vol. 140, No. 5, p 571-578. 1977. (English summary).

Descriptors: *Hydraulic gradient, *Soil moisture, Moisture tension, Depth.

A programmable procedure is described to compute hydraulic gradients from soil moisture tensions non-linearly distributed with depth. This interpolation-technique is based upon a geometrical procedure. Compared with other curve smoothing techniques it is flexible with respect to the given data constellation and requires a relatively small computational effort. This method is compared with that of cubic splines. - Copyright (c) 1978, Biological Abstracts, Inc.
W79-04723

IRREGULAR WAVE RUNUP AND OVERTOPPING,
Coastal Engineering Research Center, Fort Belvoir, VA.
For primary bibliographic entry see Field 2H.
W79-04814

8C. Hydraulic Machinery

SLUICE GATES WITH HIGH DISCHARGE COEFFICIENTS,
Concordia Univ., Montreal (Quebec). Dept. of Civil Engineering.
A. S. Ramamurthy, K. Subramanya, and B. S. Pani.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 104, No. IR4, Technical Note, p 437-441, December 1978. 4 fig, 7 ref, 1 append.

Descriptors: *Sluice gates, *Discharge coefficients, *Laboratory tests, *Model studies, Discharge(Water), Measurement, Theoretical analysis, Analytical techniques, Hydralic models, Hydraulics.

This study was undertaken to obtain higher values of discharge coefficient, Cd, for a sluice gate by avoiding the downstream contraction caused by the conventional gate lips. A cylindrical lip of diameter, d, was attached to the bottom of the gate to let the flow cling to the gate exit section. Consequently, a low pressure was created in the throat section which in turn yielded a higher value of Cd. Only the characteristics of flow past the gate under submerged conditions were studied. For submerged flows, Cd was highly dependent on the Reynolds number. The theoretical limit for Cd agreed closely with the experimental data when the ratio of d to gate opening, a, is large. For very low vaues of d/a and the ratio of gate opening to upstream head, the lip acted like a perturbation and Cd was of the order of 0.61. (Humphreys-ISWS)
W79-04572

MANAGING THE LOW-YIELD WATER WELL,
Hydrodyne Development Co., Forestville, CA.
For primary bibliographic entry see Field 4B.
W79-04580

8D. Soil Mechanics

GENERALIZED STABILITY ANALYSIS OF CHANNEL BANKS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
V. M. Ponce.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol 104, No IR4, Proceedings Paper 14228, p 343-350, December 1978. 3 fig, 2 tab, 6 ref, 2 append. EPA R805131010, R805457010.

Descriptors: *Stream stabilization, *Bank stability, *Slopes, *Model studies, Mathematical models, Theoretical analysis, Soil stability, Slope stability, Cohesive soils, Cohesion, Soil mechanics, Friction, Fluid friction, Banks, Channels, Soil science.

A generalized stability analysis of homogeneous bank slopes was presented. Cohesion, angle of friction, soil density, slope angle, and height were taken into account. The factor of safety against failure, as calculated for a suitable failure circle by the Simplified Bishop method, was expressed in terms of a stability number. Generalized charts relating the factor of safety to the slope height were developed. (Sims-ISWS)
W79-04574

8E. Rock Mechanics and Geology

HARD-ROCK WELLS GET MARIPOSA THROUGH THE DROUGHT,
California Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 3B.
W79-04579

8G. Materials

FAILURE CRITERIA FOR CORRUGATED-PLASTIC DRAIN TUBING,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Engineering.
P. N. Walker, C. L. Armstrong, and P. N. Singh.
Paper No. 78-2439, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois, 13 p. 8 fig, 2 tab, 5 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Plastic pipes, *Subsurface drains, Failure(Mechanics), Subsurface drainage, Pipes, Deflection.

Results from hydraulic-capacity, pipe-stiffness, and live-load carrying-capacity tests of permanently deflected drain tubing are presented. These tests are part of a continuing effort to define failure criteria for plastic drain tubing. (Skogerboe-Colorado State)
W79-04979

PREDICTION OF DEFLECTION FOR CORRUGATED PLASTIC TUBING,
Ohio Agricultural Research and Development Center, Columbus. Dept. of Agricultural Engineering.
A. D. Fenemor, B. R. Bevier, and G. O. Schwab.
Paper No. 78-2542, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois. 13 p, 4 fig, 3 tab, 13 ref. ASAE, St. Joseph, Michigan.

Descriptors: Subsurface drains, *Plastic pipes, Failure(Mechanics), Deflection, Pipes, *Subsurface drainage.

Measured deflections of tubing buried five years ago in a silty clay showed that the soil provides practically no side support against deflection. With measured deflection lag factors, the Iowa formula was the best of four methods for predicting deflection. Recommended maximum depths of burial are tabulated for tubing up to 381 mm diameter. (Skogerboe-Colorado State)
W79-04983

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

BIBLIOGRAPHY OF THE LITERATURE ON DROPWISE CONDENSATION, 1930-64,
Franklin Inst., Philadelphia, PA.
For primary bibliographic entry see Field 3A.
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BIBLIOGRAPHY OF MEMBRANE TECHNOLOGY PERTAINING TO SALINE WATER DESALINATION: PART II.
Office of Water Research and Technology, Washington, DC. Biosciences Div.
For primary bibliographic entry see Field 3A.
W79-04945

10D. Specialized Information Center Services

CORROSION TEST PROGRAM,
Rice (Cyrus Wm.) and Co., Pittsburgh, PA.
For primary bibliographic entry see Field 3A.
W79-04677

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W79-04792 7C
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W79-04794 5B
W79-04795 7C
W79-04796 6D
W79-04797 7C
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W79-04803 7B
W79-04804 4A
W79-04805 6A
W79-04806 2H
W79-04807 5B
W79-04808 6A
W79-04809 7C
W79-04810 5E
W79-04811 7B
W79-04812 2E
W79-04813 6A
W79-04814 2H
W79-04815 5C
W79-04816 5C
W79-04817 5C
W79-04818 5C
W79-04819 5C
W79-04820 5C
W79-04821 5C
W79-04822 5C
W79-04823 5C
W79-04824 5D
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W79-04826 5C
W79-04827 5C
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W79-04829 5C
W79-04830 5D
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W79-04832 5C

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W79-04834	5C
W79-04835	5C
W79-04836	5C
W79-04837	5C
W79-04838	5C
W79-04839	2B
W79-04840	5B
W79-04841	5B
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W79-04915	4A
W79-04916	4A
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W79-04918	2J
W79-04919	5B
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W79-04967	6A
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W79-04970	5A
W79-04971	5B
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W79-04996	3F
W79-04997	3F
W79-04998	4B
W79-04999	3F
W79-05000	5B

ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTAL
A. CENTERS OF COMPETENCE		
Colorado State University, Irrigation Return Flow Quality	W79-04605--04608 04648--04650 04653--04662 04905--04921 04977--05000	58
Cornell University, Policy Models for Water Resources Systems	W79-04609--04616 04618 04686--04693 04695 04697--04702 04704--04705 04709--04718 04789	37
Franklin Institute (FIRL), Municipal and Industrial Wastewater Treatment Technology	W79-04596--04598	3
Illinois State Water Survey Hydrology	W79-04562--04576 04590, 04599 04602--04604 04719--04722 04724--04750 04752--04753 04814, 04839 04843, 04859 04870, 04878 04901, 04903 04950	62
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National Water Well Association, Water Well Construction Technology	W79-04577--04580	4

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SOURCE	ACCESSION NUMBER	TOTAL
A. CENTERS OF COMPETENCE (CONTINUED)		
University of North Carolina Metropolitan Water Resources Planning and Management	W79-04852--04858 04860--04869 04871--04876 04922	24
University of Wisconsin, Eutrophication	W79-04528--04533 04535--04553 04621--04623 04763--04787	53
University of Wisconsin, Water Resources Economics	W79-04522--04527 04620 04756--04757 04759--04762	13
B. STATE WATER RESOURCES RESEARCH INSTITUTES	W79-04501 04554--04557 04583--04586 04591--04595 04625, 04627 04647 04683--04685 04788 04957--04964 04966--04967	31
C. OTHER		
Army Engineer Waterways Experiment Station	W79-04923--04934	12
BioSciences Information Service	W79-04703 04706--04708 04723, 04751 04758	7

ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTAL
C. OTHER (CONTINUED)		
Environmental Information Services, Inc. (Effects of Pollutants on Aquatic Life)	W79-04587--04589 04600--04601 04617, 04619 04624, 04626 04628--04629 04651--04652 04694, 04696 04815--04838 04840--04842 04844--04851 04877 04879--04881 04968--04976	63
Information Planning Associates, Inc.	W79-04502--04521 04663--04667 04669--04682 04935--04949 04951--04956	60
National Oceanic and Atmospheric Administration	W79-04582	1
Ocean Engineering Information Service (Patents)	W79-04882--04898	17
Ocean Engineering Information Service (Outer Continental Shelf)	W79-04559--04560 04899--04900 04902, 04904	6
Office of Water Research and Technology	W79-04754, 04965	2
U. S. Geological Survey	W79-04790--04813	24
University of Massachusetts (Wetlands)	W79-04558	1

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SOURCE	ACCESSION NUMBER	TOTAL
C. OTHER (CONTINUED)		
Environmental Information Services, Inc. (Effects of Pollutants on Aquatic Life)	W79-04852--04859 04860--04869 04871--04876 04922	24
[illegible]	W79-04528--04533 04535--04553 04621--04623 04763--04787	53
[illegible]	W79-04522--04527 04620 04756--04757 04759--04763	13
Information Planning Associates, Inc.	W79-04501 04554--04557 04585--04586 04591--04595 04625, 04627 04647 04683--04685 04788 04957--04964 04966--04967	31
National Oceanic and Atmospheric Administration	W79-04582	1
Ocean Engineering Information Service (Parents)	W79-04682--04698	17
Ocean Engineering Information Service (Outer Continental Shelf)	W79-04559--04560 04699--04900 04902, 04908	0
Office of Water Research and Technology	W79-04754, 04965 W79-04923--04934	12
U. S. Geological Survey	W79-04790--04813	7
University of Massachusetts (Wetlands)	W79-04558 04705--04708 04722, 04751 04758	1